

DEWATERING & SILENT PILING



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## ABOUT US

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**Dewatering & Silent Piling** is a construction company highly skilled for its complex soil dewatering and retention projects with steel and plastic piles. Our company intervenes in any type of construction: industrial and residential, road and rail, river and maritime, addressing both public and private customers. It provides state-of-the-art manufacturing methods and technologies on the Romanian market to improve the environmental performance of the construction industry.

The flood protection system, the development of dam structures or the dewatering processes of a site are just a few niche projects that aim to protect the shore against water infiltration and to support a solid foundation structure for large projects built in areas with high groundwater levels. The steel or synthetic piles are an effective solution that balances costs, time and execution speed for building flood protection structures. We offer consulting, design and execution solutions for the isolation of landfills, chemical plants, oil extraction areas, or any contaminated or potentially contaminated site. For all of these, we have technologies which allow faster construction of dams and dykes docking structures

# CERTIFICATIONS



*Dewatering and Silent Piling is based on a quality orientation, this being the primary objective within the organization, considering the need to control the elements of risk both on the natural and anthropogenic environment. In order to meet the needs of our customers interested in the products and services we offer, we are careful that the projects are planned and carefully monitored, controlled and assessed throughout the entire period of development, as well as improved so that all the proposed objectives are achieved. As a result of such an approach, **Dewatering and Silent Piling** has been praised by the International Organization for Standardization being certified by:*

*SR EN ISO 9001:2008 on quality management*

*SR EN ISO 14001:2008 on environmental management system*

*SR EN ISO 45001:2018 on occupational health and safety management systems*

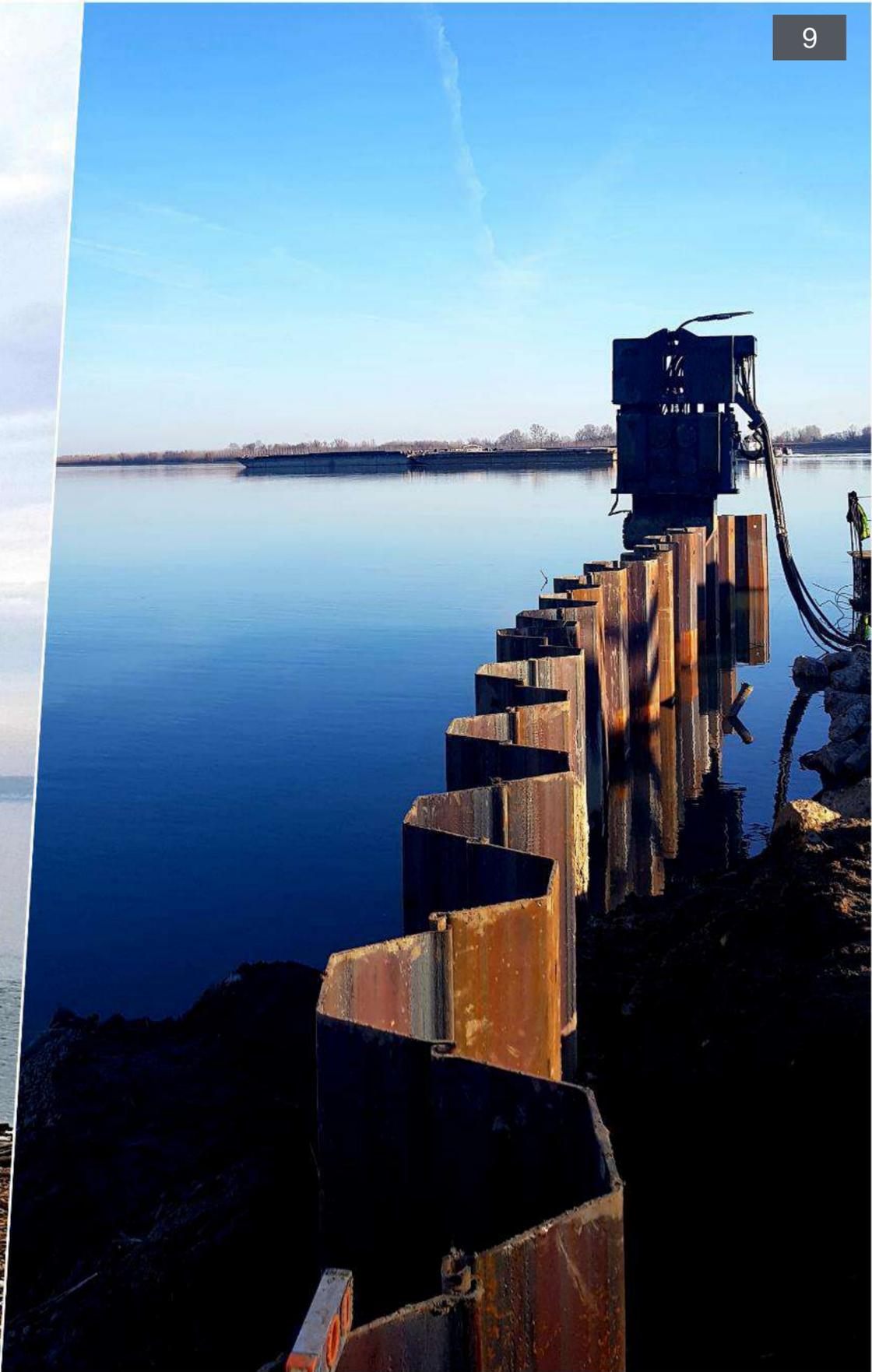
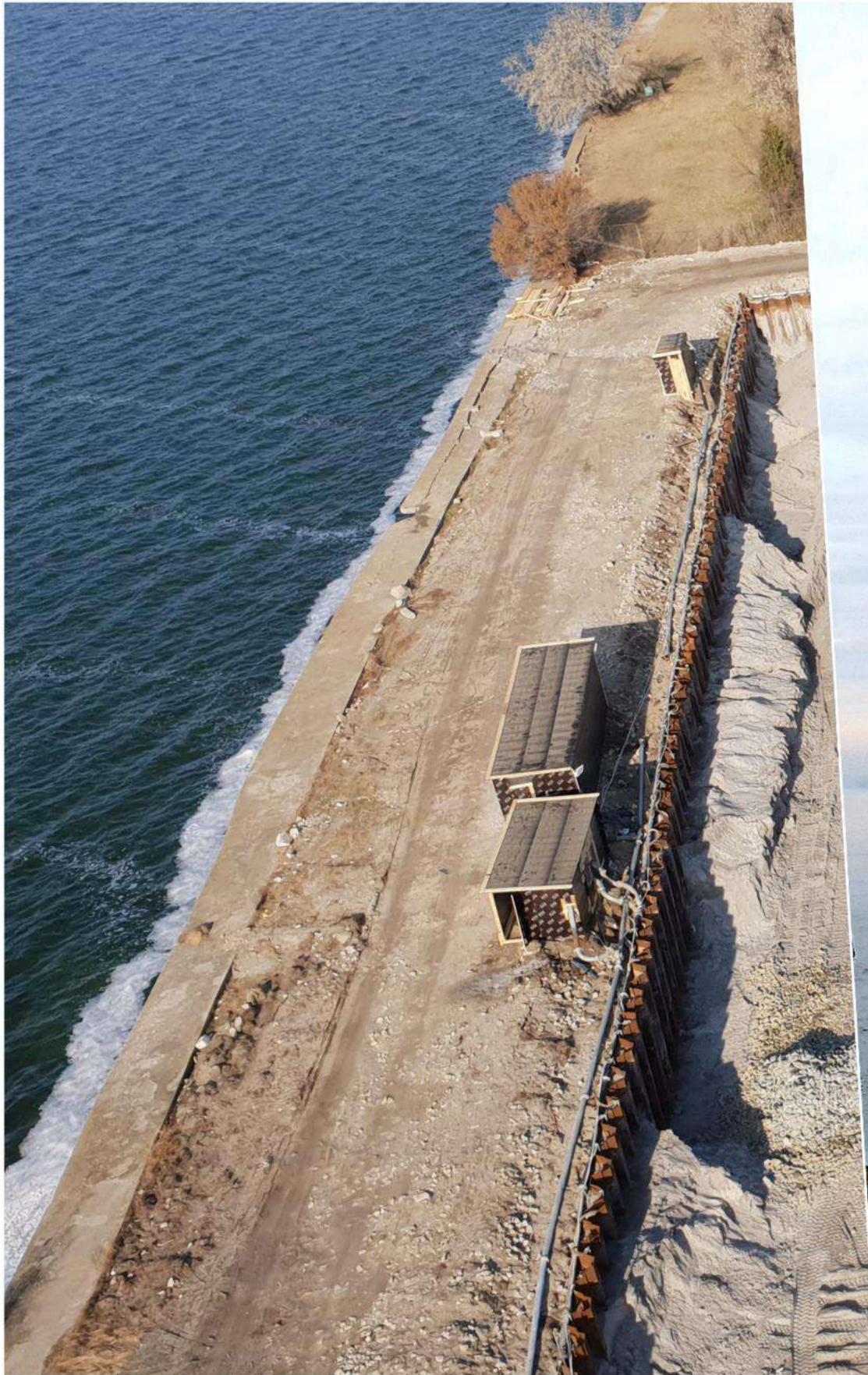








## HYDROTECHNICAL CONSTRUCTIONS





## FLOOD PROTECTION

Floods are hydrological hazards that cause great damage to both material level and to human lives. Their production is due to the penetration into river beds of large amounts of water that can cause landslides, shore-shaking, dams rupture.

**Dewatering and Silent Piling** is concerned about these hydrological hazards, providing effective solutions for building flood protection structures in the form of metal piles, while equalizing costs, time and execution speed.



## STEEL SHEET PILES

The sheet pile walls can be used in many situations, either as flood defence systems or for river banks protection. To create new embankments, the walls provide both impermeability and stability. They can also be used to strengthen existing embankments. When space becomes a problem, in ports or in urban areas,

the pile walls can turn into self-defence walls. In fact, the metallic pile walls can be used to protect buildings against ground breaks. In this case, the wall of the metal pilings is built outside the dyke, so the nearby buildings are isolated from the dyke, eliminating the adverse interactions between the dyke and the buildings. The metallic pile walls built at the foot of the dyke have an important role in stabilizing the slope and redirecting the pressure of the earth from the shoulder of the dyke to the foundation. This can be done by fitting the metal piling up to an optimal depth. If the raised shore height exceeds 3-4 m, the piling may need to be anchored. The "shoulder" of the dike stabilized in this way may be more steep, which is impossible to do without the use of metal piling. In fact, the metallic pile walls can be used to protect the buildings against ground

breaks. In this case, the wall of the metal piling is built outside the dyke, so the nearby buildings are isolated from the dyke, eliminating the adverse interactions between the dyke and the buildings. The use of metal piles in the construction of the dyke also gives us the possibility of changing it in order to deal with a larger quantity of water without the need for more space. This is done by designing the wall of the metal piling depending on the height required for the dyke's crest of waves. This results in a smaller footprint of the dyke compared to the footprint that would result for the same height without the use of piling. As a flood protection, the wall of metal piling replaces the dyke without any decrease in its strength. The solution is very advantageous for areas with limited space, port areas or other locations.





# CHARACTERISTICS

## MAIN

## ADVANTAGES

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For flood protection and river bank protection, the pile walls have a number of advantages:

### **Tightness**

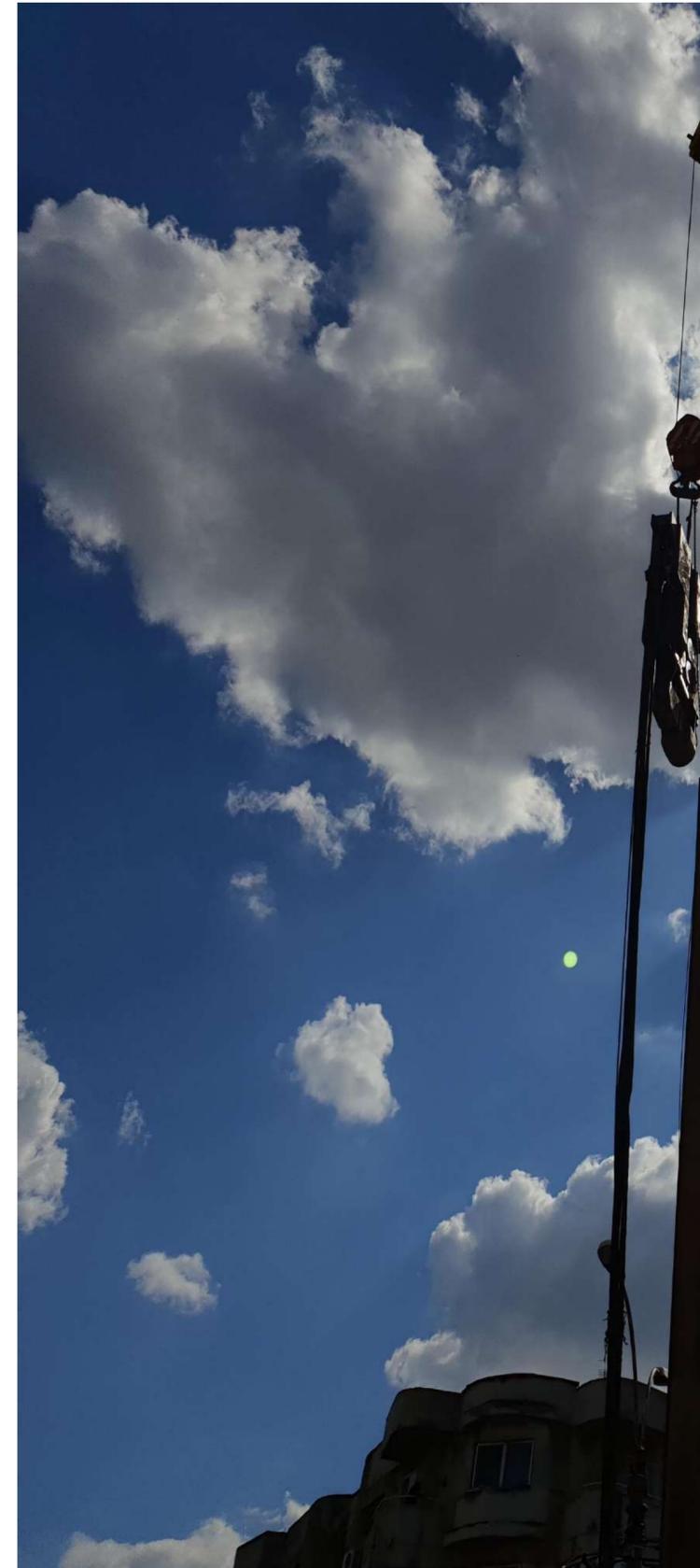
Metallic sheet piles are often used as sealing thresholds in the

construction of flood protection dams. The sealing of metal piles can be achieved by naturally depositing earth in their interlocks. For a complete sealing of the interlocks, different filling solutions can also be used. A wall of metal piles with a threshold role, not only reduces or prevents infiltrations inside the dyke but also improves its stability. The degree of sealing of the metallic pile walls may vary considerably, depending on the type of pile chosen or whether or not interlocking sealing solutions are used and what type of solution is chosen. If a metallic pile wall has the function of supporting the earth, but the outer "shoulder" should be prevented from drying completely, drain holes can be made for the water to pass. Information on water drainage through the metallic pile walls can be found in European Standard EN

12063, Annex E. This also reduces the hydraulic pressure from the shore, as flood levels of the rivers decrease. When the limited workspace affects the construction of a flood defence system, inserting a pile wall is a unique solution, saving space and making it easier to reach the goal. It is easy to integrate into the landscape and meets the strictest aesthetic requirements. It should be reminded, however, that if the metallic pile wall is not embedded in an impermeable layer, only numerical calculations can accurately determine the flow and the infiltration line.

### **Durability**

The loss of thickness of the metal piles on the enclosed area is virtually null.





Freshwater corrosion rates are also low. For aesthetic reasons, a form of coating with different solutions is applied.

### **Erosion**

Dangers resulting from rodents dug out (rodents are potential drainage channels) can be eliminated by using pile walls. The same applies to the risk of damage caused by the roots of the trees. Penetration of resulting waterproof areas and the creation of drainage pathways can be prevented - unlike other systems used. The delineations made by the metallic pile walls open new possibilities for soil treatment: due to the fact that they are impenetrable, ecology of the slopes can be considered.

### **Ductility**

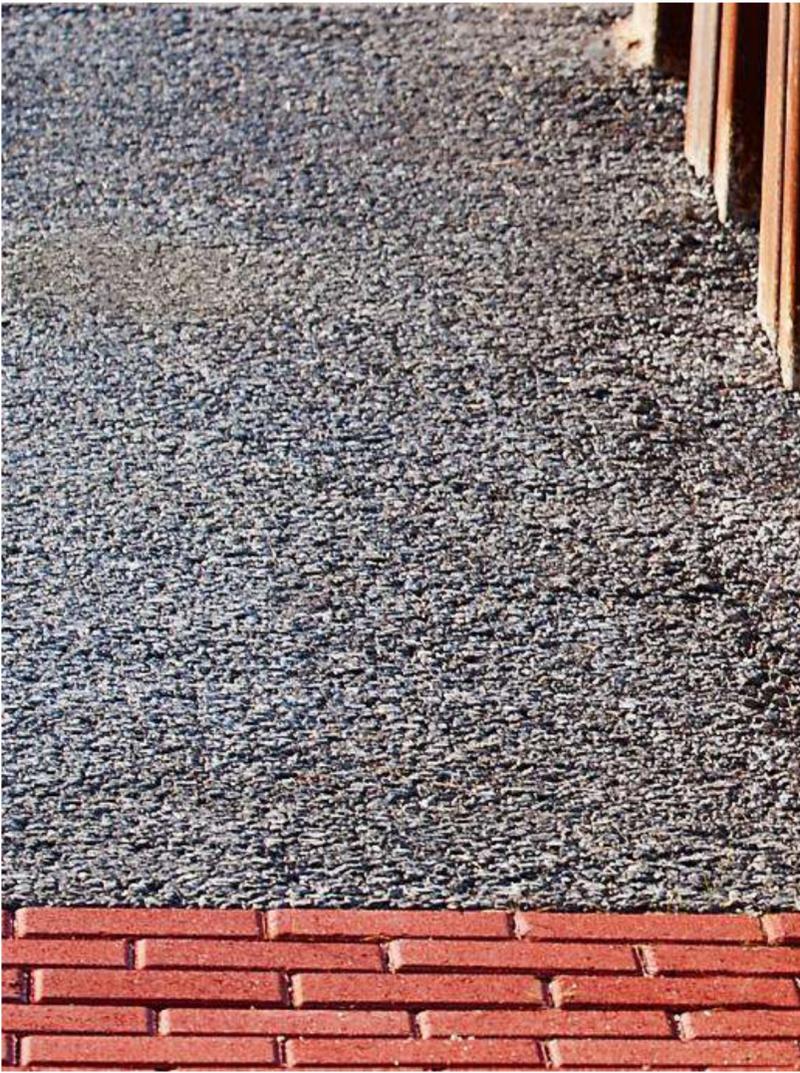
Steel is ductile: before a pile wall yields, a gradual deformation process will be observed. This warning provides a reaction time in which the structural defects can be identified, and hence they can be remedied by appropriate remedial measures.

# LANDSCAPING RESPECTING THE NATURAL HABITAT

At the metallic pile walls, the image of the canals' dykes can be very natural, fulfilling not only aesthetic criteria but also economic and ecological requirements. The metallic pile walls serve as protection against floods or as a support for the dam, they must match as far as possible in the urban or rural landscape. The piles and can be painted, plated with wood, brick or stone, or masked by plants. Appropriate planting encourages the restoration of ecosystems that can be damaged by human intervention.

In urban areas, it is often possible to plate the metallic piles with stone for a better aesthetic appearance. Unplated metallic pile walls are most commonly encountered in industrial locations, such as port structures (quay walls). Brick or stone plating offers an enormous variety of design and in many cases can even be complemented and enhanced with appropriate plants. The use of prefabricated elements significantly increases the speed at which the plating can be done. For the cladding stone, local conditions

should be taken into account. In urban areas, it is generally necessary that the flood defence system does not prevent river sight. This requirement can be fulfilled by leaving gaps in the wall, which, when needed, can be closed with different detachable systems. If necessary, an alternate flood defence system can be built with high-strength structural glass panels above the metallic pile wall. Covered with plants, a metallic pile wall along the banks of a canal will have attractive and natural





attributes. Greening has a positive effect on the landscape and the quality of life, especially as waterway dykes are generally regarded as recreational areas. Since greening must take into account the local landscape and ecological requirements, its success will depend largely on selected plants. Ideally, the natural ecosystem should be preserved by modifying it as little as possible. With the help of the metallic pile walls, the "shoulders" of the dyke can be grassed,

as there is no risk of the barrier being damaged by the roots, etc. In the case of canal dykes, tree planting provides traffic benefits from the point of view of wind protection. It should be remembered, however, that plants should not be an obstacle to inspecting the dyke.



## STEEL SHEET PILE WALLS

### CHOOSING THE SOLUTION

When choosing the sections for metallic piling, account must be taken of both the installation method and the strength of the piles. If the piles are used only for the construction of a sealing barrier, without any supporting role, the choice of profiles

will be based exclusively on the enclosing and sealing method. But if the metallic piles wall acts as a supporting wall, the choice of profiles will be based mainly on the geometrical characteristics. Obviously, the designer will also take into account other criteria such as (soil type, installation mode, etc.), which will determine the maximum length of the pile wall

Together, the transverse section of a dyke and the profile chosen for the metallic pile wall will give rise to several constructive variants. This will depend on the project, whether it is flood protection or dyke protection, and depending on the site's characteristics. The loads that the metallic piles are exposed to generally consist of jointly exercised earth and water pressures.

# STEEL SHEET PILE WALLS

## INSTALLATION

Dykes are vulnerable to sedimentation, which is why they may be affected by vibrations. Effects on the dike can be greatly reduced by the use of state-of-the-art vibro hammers with variable

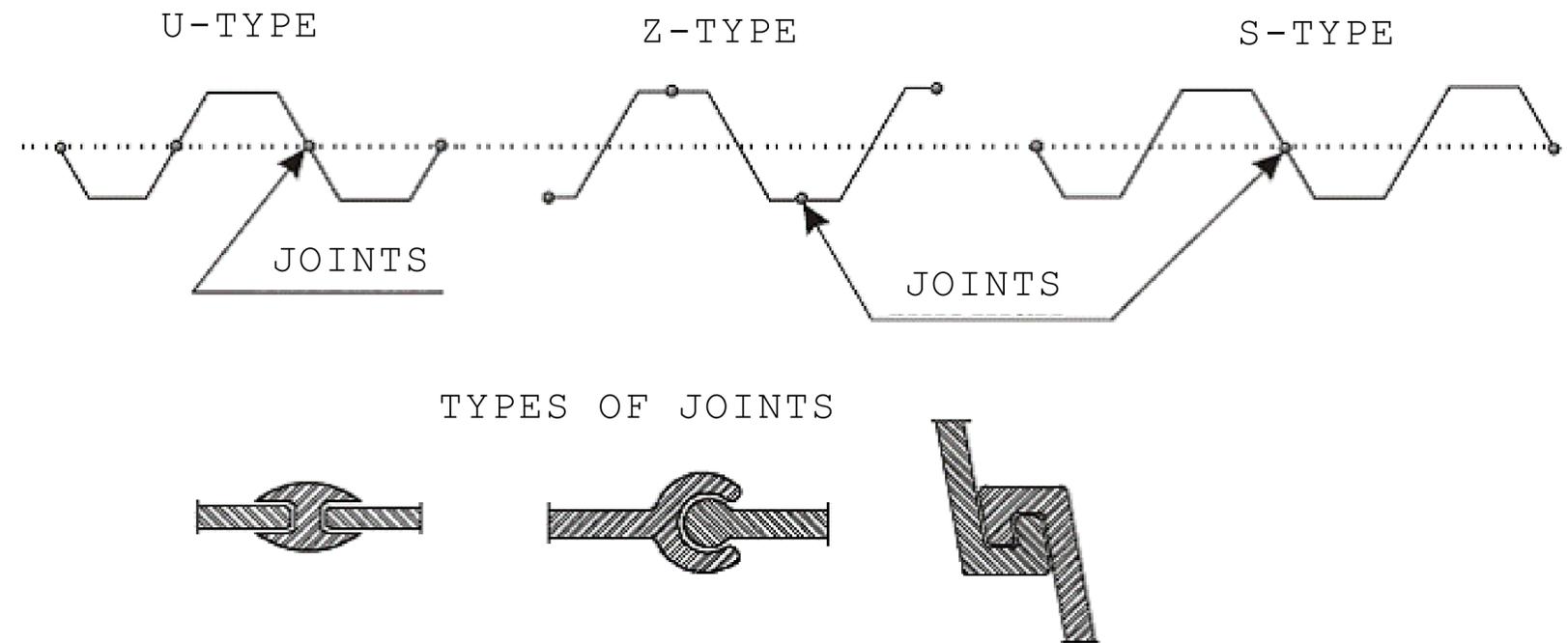
moment and high frequency. If there is any doubt, a vibration measurement system can be used; it emits a warning signal when a given vibration threshold is exceeded. Other methods of installing the piles are: pre-drilling or hydraulic pressing. Hydraulic pressing does not generate any vibration. At the same time, if the metallic pile wall acts as a threshold, careful

use is recommended to ensure the wall integrity. High frequency (non-resonant) vibration systems result in fewer disturbances when the piles are installed. In particularly sensitive cases, the piles can be hydraulically pressed along their entire length without the slightest disturbance (noise, vibrations) Also, the pile walls can be

### Types of joints

Metallic piles are used for deep digging, well below hydrostatic level. They may be used definitively or provisionally, their recovery being possible, so that they can be reused. They are laminated profiles of type U, S or Z and are distinguished by their shape and the way of interlocking

driven as easily into the water as on the ground. The time required for the preparation of the land before the start of the works is minimal, which allows them to start after a short period of time. The fact that a single component combines the sealing and supporting function also contributes to optimizing costs and construction time.



# SYNTHETIC SHEET PILES

ADVANTAGES  
MECHANICAL  
CHARACTERISTICS

Synthetic piles are made of PVC (vinyl polychloride or composite material). They are an alternative solution to steel piles, concrete dykes, gabions, or rock fills in various hydrotechnical projects and beyond. Synthetic piles have a wide range of significant mechanical advantages and features such as:

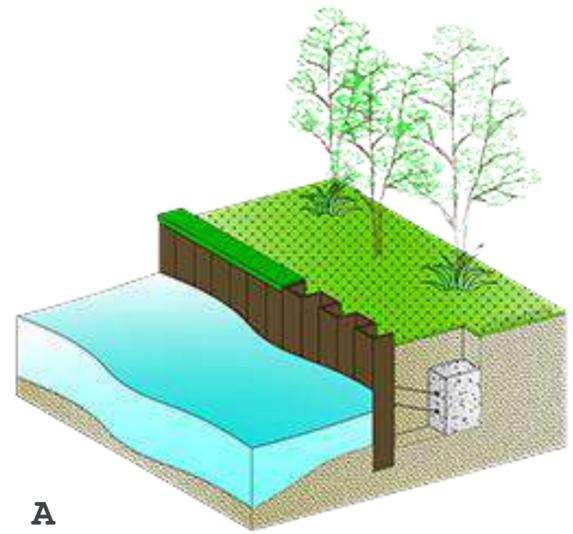




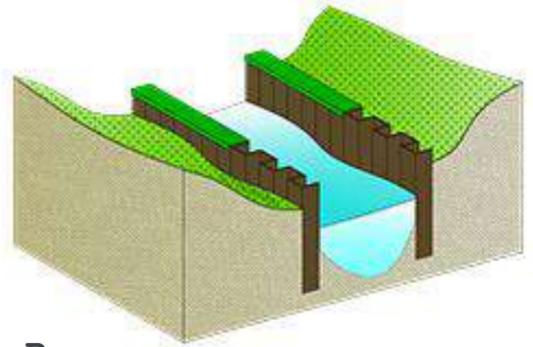
- They are 100% ecological, being made of recyclable materials that do not contain substances that affect the environment;
  - No toxic treatments on the piles' surface;
  - They do not require maintenance;
  - They have a long life;
  - They are resistant to corrosion and salt water;
  - They are resistant to UV;
- Due to the material they are made of:
- they are lightweight,
  - they are easy to handle and transported.



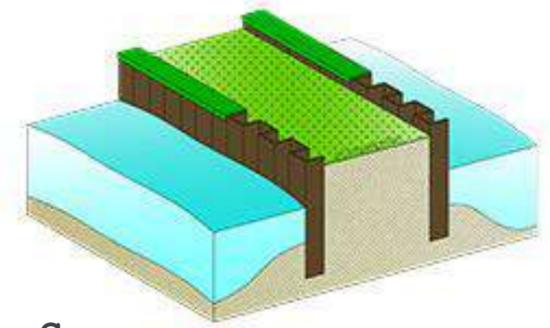
- A. Consolidation, shore protection and embankment restoration
- B. Irrigation channel construction, construction of retention basins, river bank restoration
- C. River bank protection
- D. Protection against erosion
- E. Construction of supporting walls, hydraulic barriers against infiltration
- F. Securing landslides
- G. Flood barriers
- I. Surrounding polluted areas, isolation of



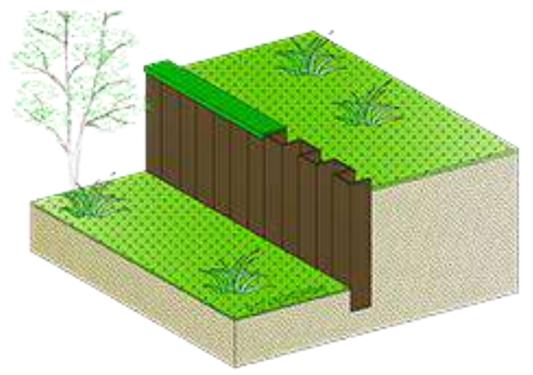
A



B

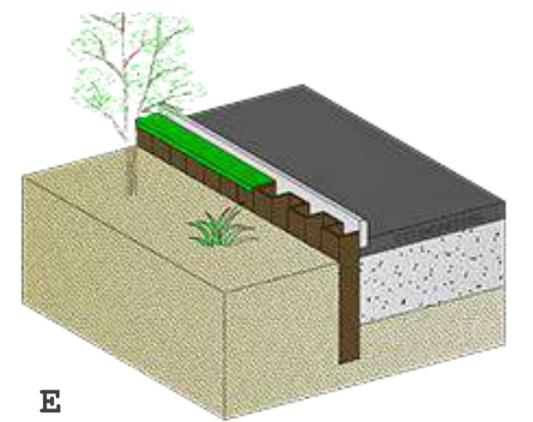


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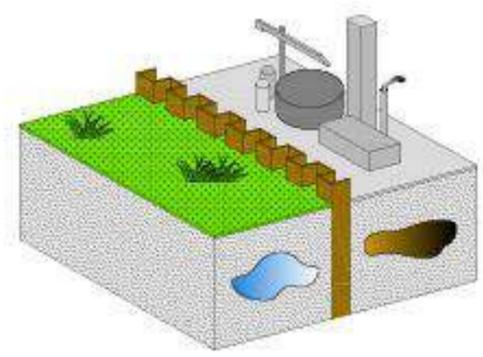


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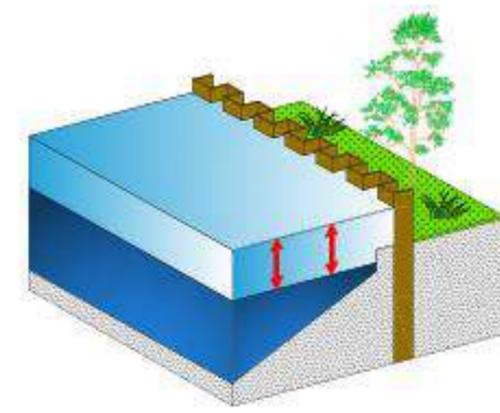
## USEFUL APPLICATIONS OF SYNTHETIC SHEET PILES



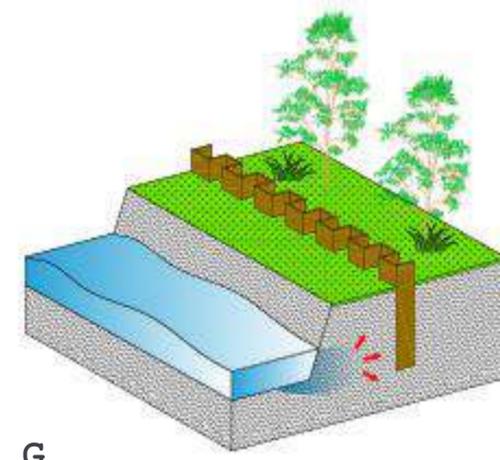
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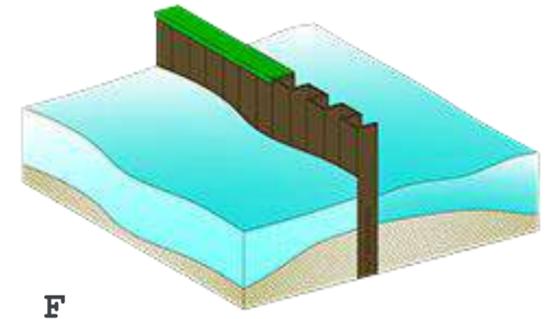
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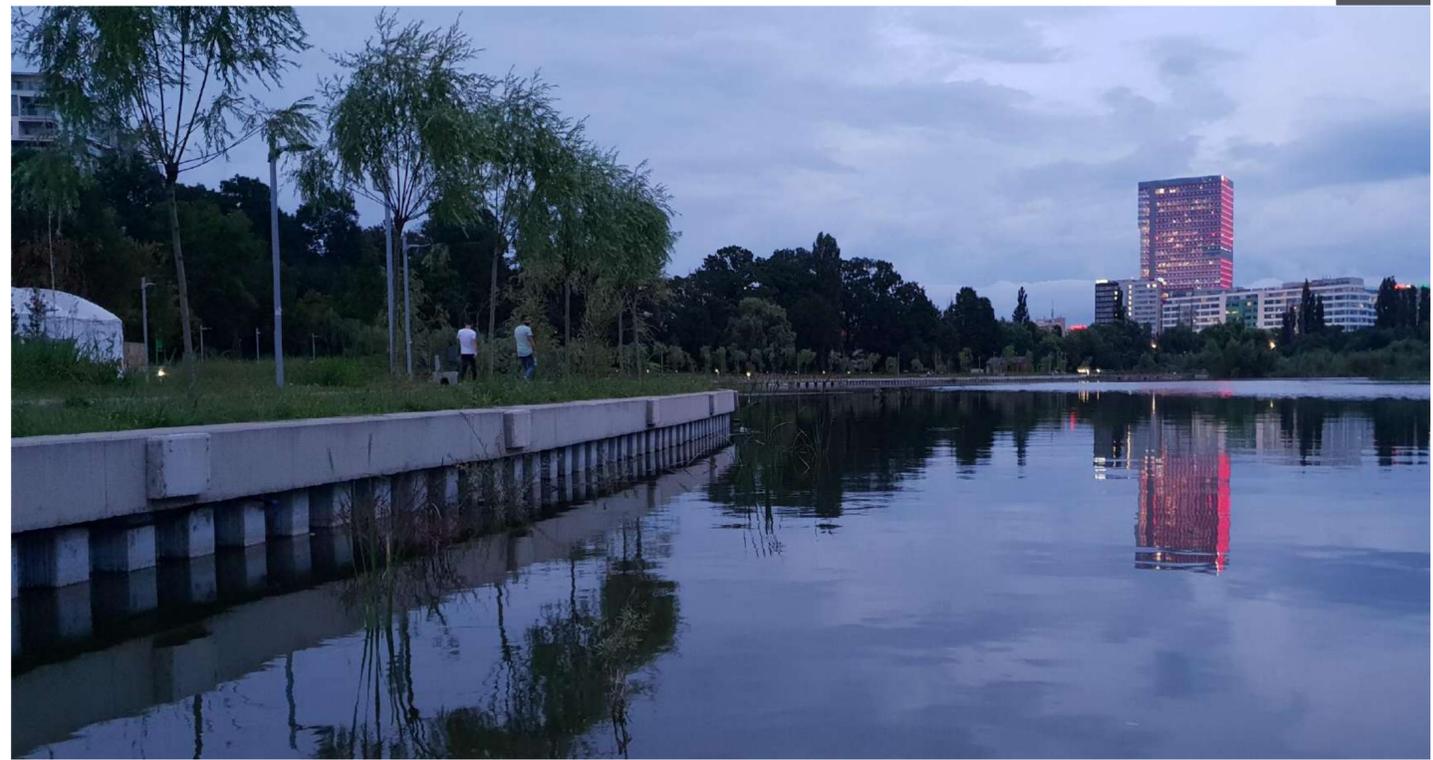


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CONSTRUCTION OF A  
ARTIFICIAL PENINSULA





HYDRAULIC  
BARRIER  
CONSTRUCTION



## DEWATERING SYSTEMS

Dewatering systems are installations that allow drilling and construction of foundations below groundwater level, thus enabling dry work surfaces. They have a variable service life, depending on the type of execution, ground water level or special measures that require their use after the works are completed.

Our company performs several types of dewatering works:

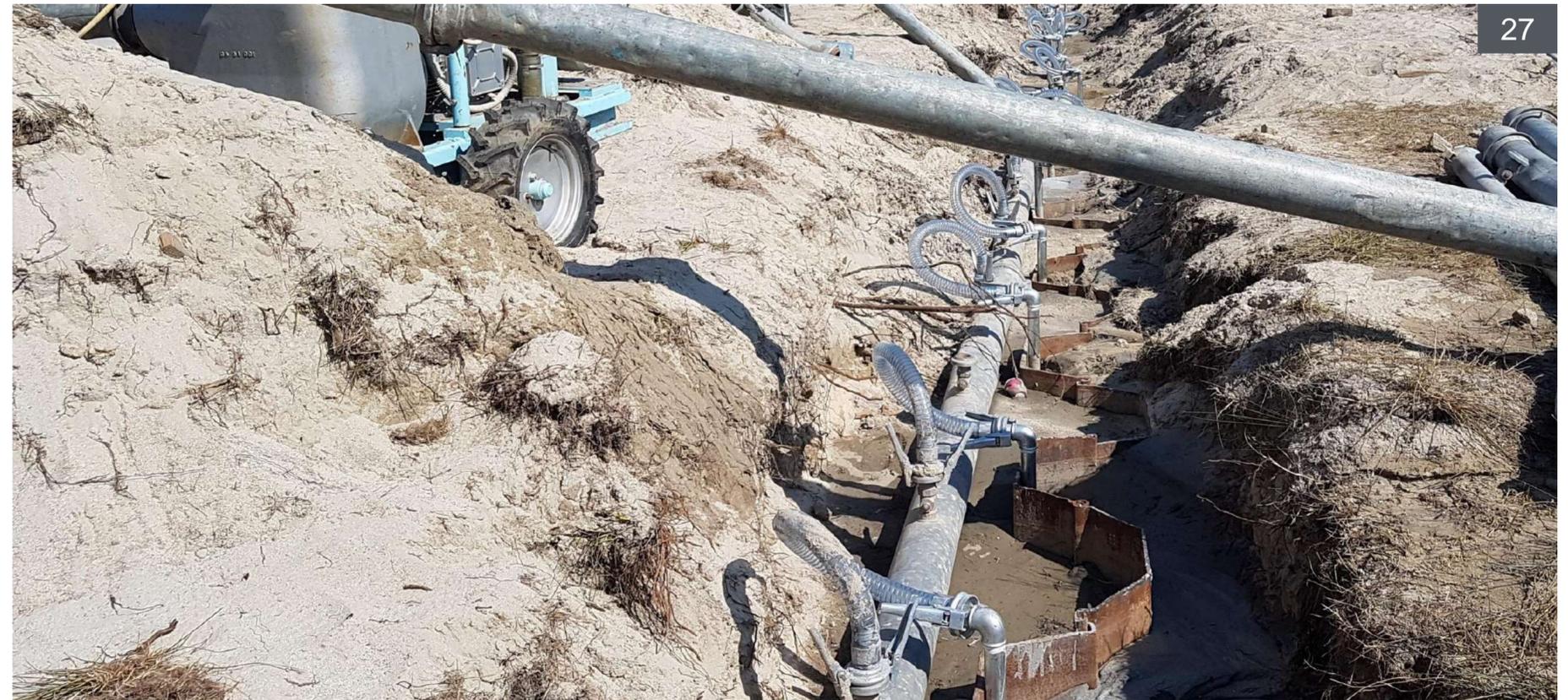
- Drilling networks equipped with filters, suction pumps or submersible pumps of various types;
- Direct water discharge from the excavated pit;
- Vacuum filters with or without vacuum.

## DRAINAGE WITH PRE-FILTER/ WELLPOINT SYSTEM

This is a special technique of dewatering / depression of the groundwater by means of wellpoint system, it is applied to low cohesive earth with relatively low permeability, sandy dusts, dusty sands, prone to hydrodynamic drive.

## DRAINAGE WITH WELLS

Used in the presence of excavations in sand and gravel dominated land, within which there is a large amount of water in the aquifer layer. These soils have a very high transmissibility, which is why the dewatering system has to be made of high diameter and high flow pumps.





## WELLPOINT SYSTEM

The wellpoint system determine the temporary decrease of groundwater, making the excavations in a professional and safe dry way. The operation principle consists essentially in the extraction of water from the ground through a set of needle filters mounted in the ground at the depth necessary for lowering the groundwater. It consists of a set of horizontal collector pipes to which a suction vacuum pump is attached. From the horizontal dispensers, the variable joints are separated, the flexible joints connected to the inflatable lifting tubes in the soil at the desired depth. At the end of the lifting tube, a reference point is installed that allows water to be sucked without removing solid soil particles.



## DRAINAGE WITH WELLS

Drainage systems that use drainage wells are used for excavations in sand or gravel areas where there is excess water due to the high level of groundwater or aquifer layer. These soils have a very high permeability, which is why the extraction probe must contain high flow and high diameter pumps. As part of the drainage technology with wells, two different methodologies can be outlined, which influence the design of pumping design. The two ways of solving the problem of drainage with wells, are: the execution of a gravitational drainage, respectively drainage by forced depressurization of the aquifer layer.

# SPECIAL FOUNDATIONS



# HIGH VOLTAGE PILLARS FOUNDATIONS

Execution of foundations for high voltage pylons by the use of metallic piles is a quite developed niche in the Dewatering and Silent Piling portfolio offering solutions for both a new foundation system and an existing one. For an existing foundation system, support elements such as metal pillars, foundation blocks, and reinforced concrete slab are protected by creating a

perimeter wall of metal piles around the existing defence enclosure. Thus, the metal piles, through the additional consolidation measures, are integrated into the foundation of the pillar, making a rigid construction in the form of a caisson. Following the execution of the perimeter enclosure made of piles it is often necessary to stabilize what has remained

within the perimeter created. In order to stabilize the contents inside the enclosure and to secure the suspended parts at risk of displacement, pressurized cement milk injections are used to cement the existing concrete pieces, resulting in a rigid element filled to the inside with elements representing the defence system of the pillar foundation.



# SYSTEMS TO ISOLATE CONTAMINATED SITES

*Currently, according to official estimates, there are 1183 potentially contaminated sites in Romania and 210 contaminated sites.*

Dewatering & Silent Piling supports the decontamination of polluted land and thus through its projects it

intervenes in the proper soil cleaning actions by sealing and preparing them for subsequent cleaning processes. The use of piles as a solution within the intervention is a well-known method for our company due to its benefits in terms of both environmental impact, safety and cost and time efficiency. Besides, our specialists offer

consultancy, solutions and support for the entire period of the intervention. The intervention area requires sealing by implanting a perimeter wall of metal piles to delimit the area of intervention from the rest of the territory. This process aims at simultaneous depollution of soil and groundwater.



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The problem of soil and groundwater contamination is one of the fundamental elements of environmental protection in national and European Union policies.

## WATERPROOF SHIELDING

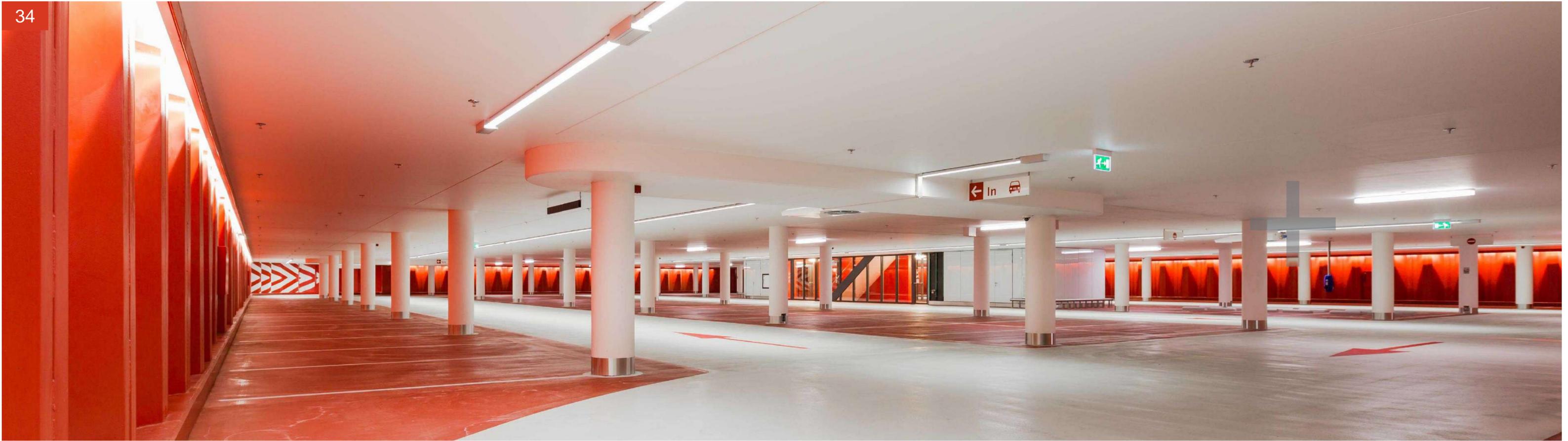
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Environmental pollution may be chronic or historical, as a result of the accumulation of pollutants and sedimentary substances that have settled over time, affecting deep soil levels up to the groundwater. At the same time, environmental contamination may also be accidental as a result of accidental discharge of contaminants / materials during transport or handling.

### Waterproof shielding

The degree of contamination of this type of pollution may vary depending on the volume of polluting materials, the duration of the pollution and the conditions of expansion of the contaminated area. In order to reduce the level of contamination, it is necessary to limit the extent of pollution at all soil levels. Thus, pollution can be temporarily halted by applying environmental or permanent environmental methods by sealing the contaminated area and creating walls with treatment gates that provide a physical limitation. This type of insulation is called waterproof screening and has the role of insulating the contaminated surface rather than depollution. By shielding it, you can control the underground water flow in a certain area, thus reducing contact with areas affected by

pollution. With these screens, a completely isolated enclosure is formed around the contaminated area. If groundwater levels increase, it is necessary to control them so that they do not reach the protected area. Measures to control the water level are made by making extraction wells in the enclosure or by covering the enclosure surface with an impermeable layer that stops the infiltration of surface water. The coating layer can be made from both synthetic membranes and clay, provided that a drainage of rainwater is provided. Metal or synthetic piles can be used to make the screens according to the structure and characteristics of the contaminated area that can only be determined by a specialized assessment.



## UNDERGROUND PARKINGS AND PASSAGES

Dewatering & Silent Piling provides an effective alternative to conventional methods of building underground car parks, road or rail passages, by the use of steel sheet piles in plain sight.

It has major advantages comparing to the conventional methods. The time reduction of the construction process is ensured by the working method speed and by getting rid of different necessary stages for the classical methods. Final costs are significantly reduced by maximizing the excavation space and by removing additional buildings to support excavation, such as those

related to securing and supporting walls. In addition, our solutions guarantee the sealing and prevention of groundwater infiltration. On the entire surface of the traditional diaphragm, the material exhibits a certain level of porosity, while the well welded and/or treated sheet piles with a special gel can provide tightness.

# STEEL SHEET PILES AS DEFINITIVE STRUCTURAL ELEMENTS

The usage of steel sheet piles is a new practice, especially on the Romanian market, taking a significant role due to the structural role sheet piles fulfill.

1. First of all, the steel sheet piles have a supporting role during the excavation process to sustain the walls.

2. It creates a watertight enclosure of the digging area.

3. It offers a definitive structure as a perimeter wall and can take over loads from the vertical side of the superstructure.

## **Advantages**

The main benefit of using steel sheet piles as definitive structural elements in construction projects of underground parking lots and passages is the simplification of the entire process of execution resulting in a significant decrease of costs and time of construction.

Adopting this solution, by using steel sheet piles, the whole temporary work of supporting the excavation can be transformed into a permanent work. The resulted wall can act as a load-bearing wall or perimeter wall, which, at the end helps by reducing costs, time of execution, and ensuring high quality.

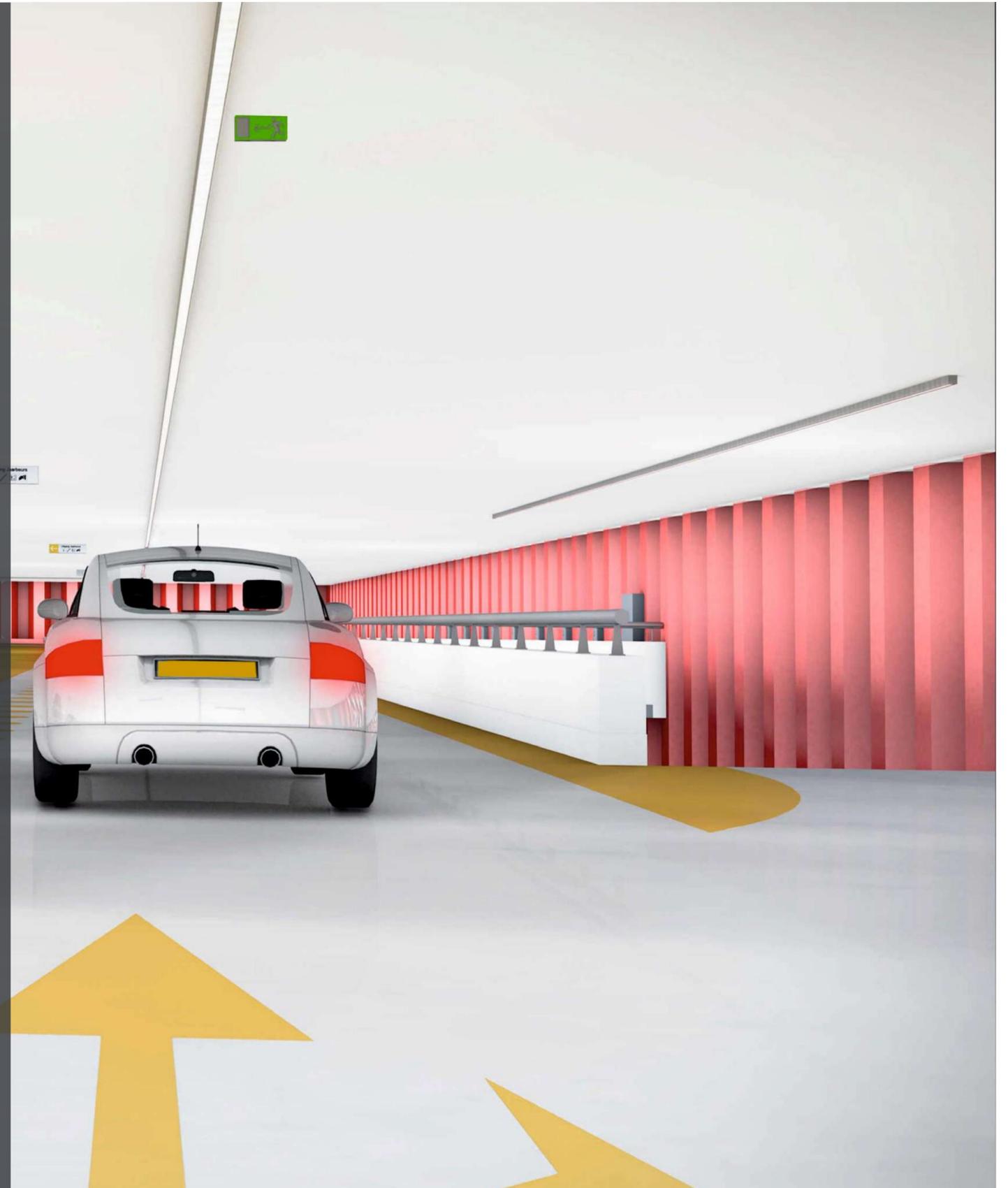


## QUICK EXECUTION

High mounting performance of the sheet piles.

No waiting time after ending up the assembling work. It furthers directly to the digging step.

After the excavation stage is completed, the infrastructure and superstructure works can be immediately started.

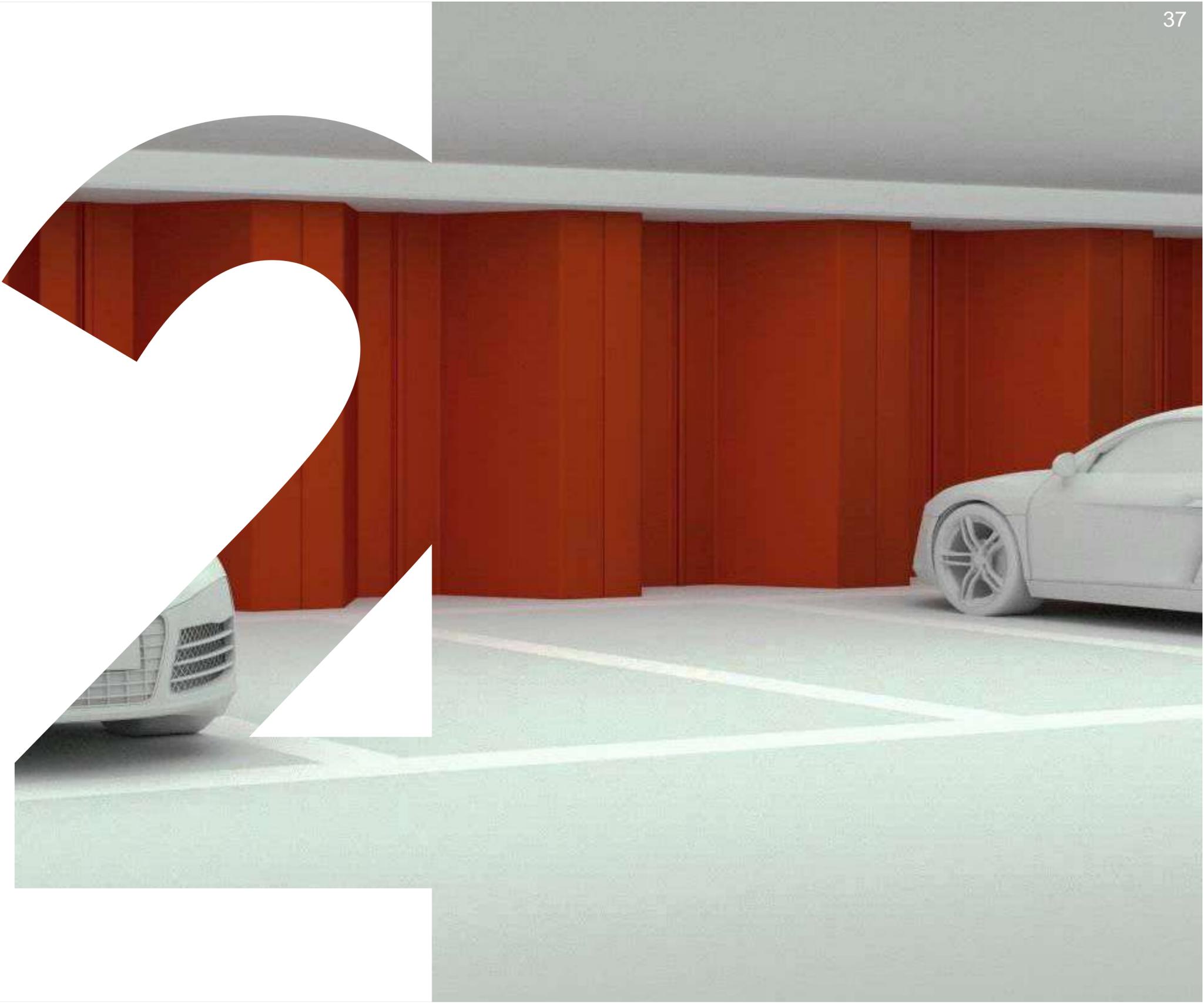


# COST REDUCTION

It eliminates the costs related to the provision and support of excavation walls (the costs for temporary works are converted into costs for final works, resulting in a single stage of construction);

It maximizes available digging space leaving no need for another interior wall.

It reduces the construction costs and time for the infrastructure wall by eliminating the need for more extensive excavation, shuttering, reinforcement, sealing, etc.





## HIGH QUALITY

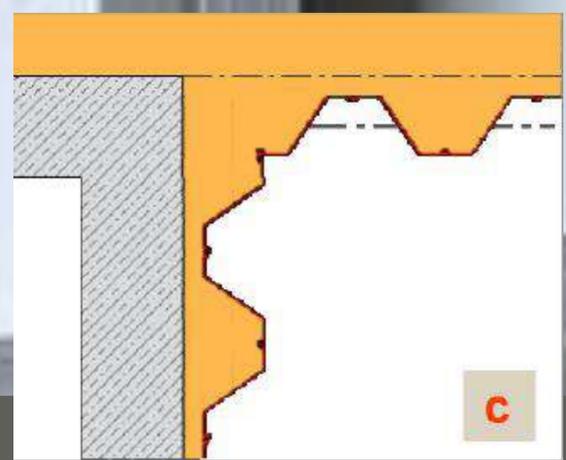
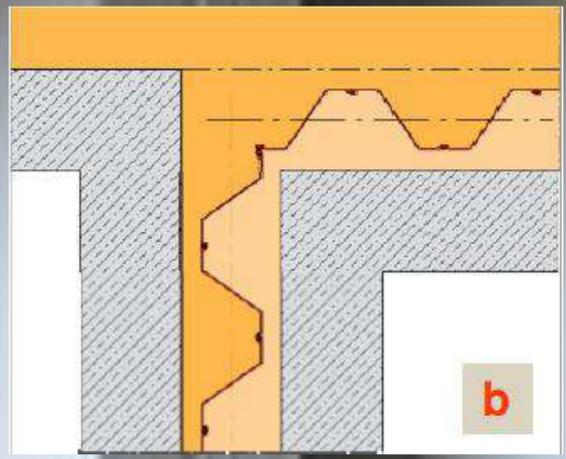
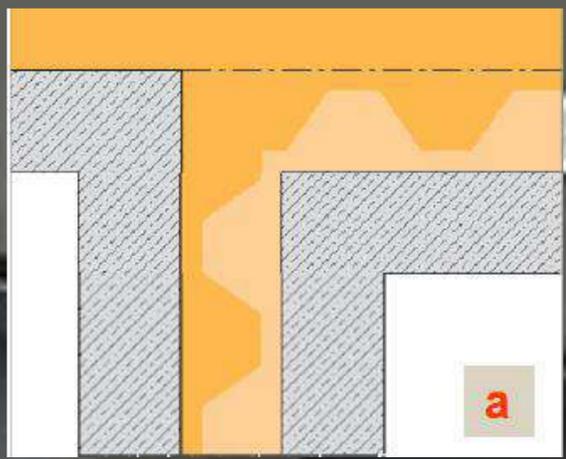
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Guarantee of leakproofness against infiltration in groundwater;

If necessary, the steel sheet pile wall can take over the vertical loads transmitted by the superstructure;

The structure is guaranteed against seismic and fire hazards in accordance with the regulations in force.

# MAXIMISE AVAILABLE DIGGING AREA



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Highlighting the difference between temporary and permanent sheet pile walls works:

Sheet piles recovered and reused in another site (a); Sheet piles unrecoverable and left in the ground - due to high extraction costs (b); High execution speed and maximum usable space inside the excavation (c).

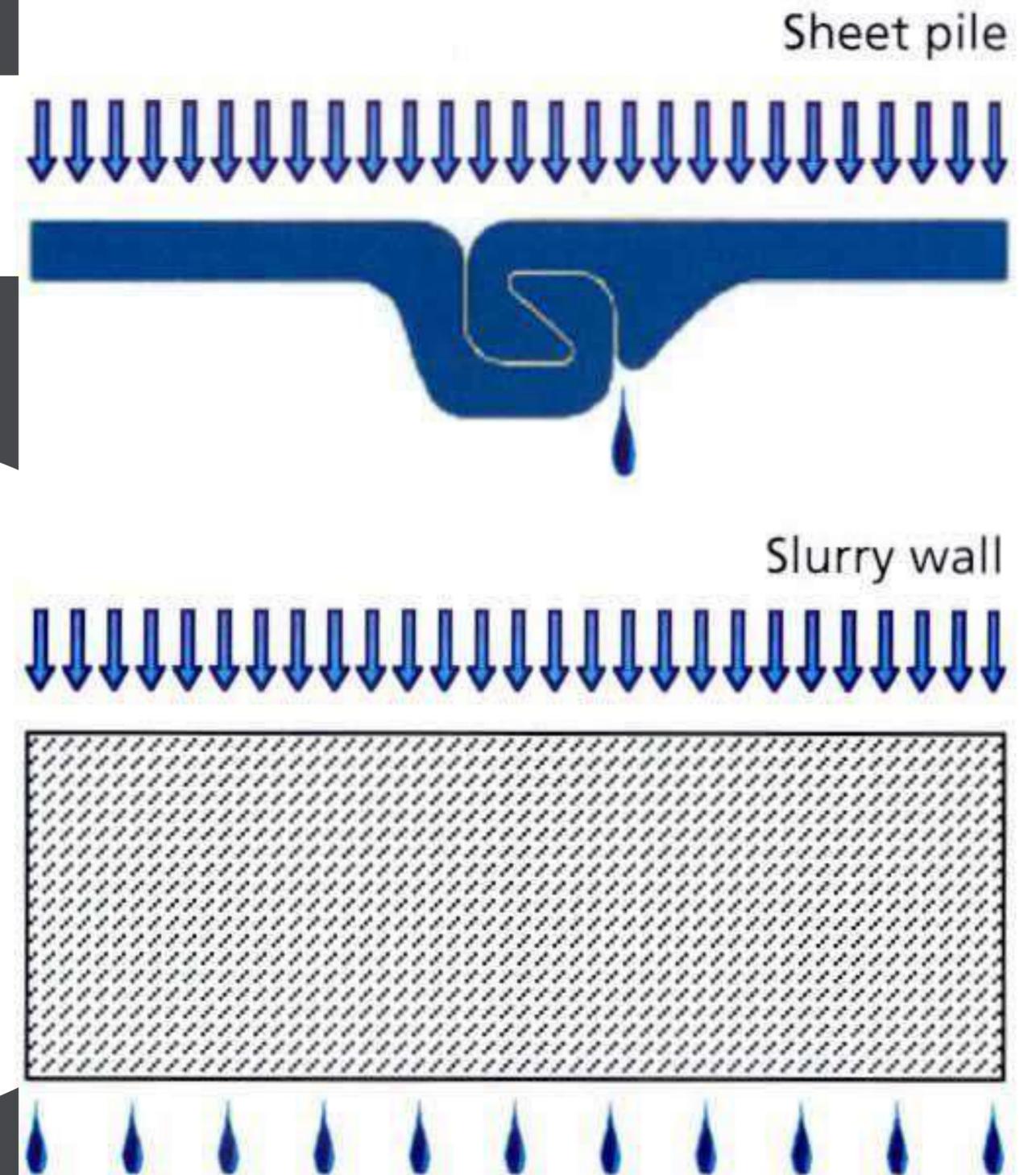
## IMPERMEABILITY

The molded wall has a certain porosity coefficient along its surface, which allows the infiltration of groundwater. In steel sheet pile walls, this infiltration of groundwater is exclusively concentrated on the interlocking area.

In order to completely stop the phenomenon of water infiltration through the interlocks, it is possible to intervene in two ways:

a. By applying sealing solutions on the interlocks (ex. Sika, Wadit);

b. By welding the interblocks.



# DURABILITY OF THE STEEL STRUCTURE

In non-aggressive, unpolluted natural lands, the corrosion level is negligible.

In fresh water, the corrosion phenomenon is low.

USEFUL LIFE	5 YEARS	25 YEARS	50 YEARS	75 YEARS	
	YEARS	100 YEARS			
	mm				
UNPOLLUTED NATURAL SOILS (SAND, DUST, CLAY)	0	0,30	0,60	0,90	1,20
POLLUTED NATURAL SOILS	0,15	0,75	1,50	2,25	3,00
AGGRESSIVE NATURAL SOILS (PEAT)	0,20	1,00	1,75	2,50	3,25
FRESH WATER (HIGH IMPACT AREA = SURFACE OF THE WATER)	0,15	0,55	0,90	1,15	1,40
POLLUTED WATERS (SEWERAGE) HGH IMPACT AREA = SURFACE OF THE WATER	0,30	1,30	2,30	3,30	4,30
SEA WATER (WAVE IMPACT AREA, LOW WATER LEVEL)	0,55	1,90	3,75	5,60	7,50
SEA WATER (PERMANENT IMMERSION AREA)	0,25	0,90	1,75	2,60	3,50

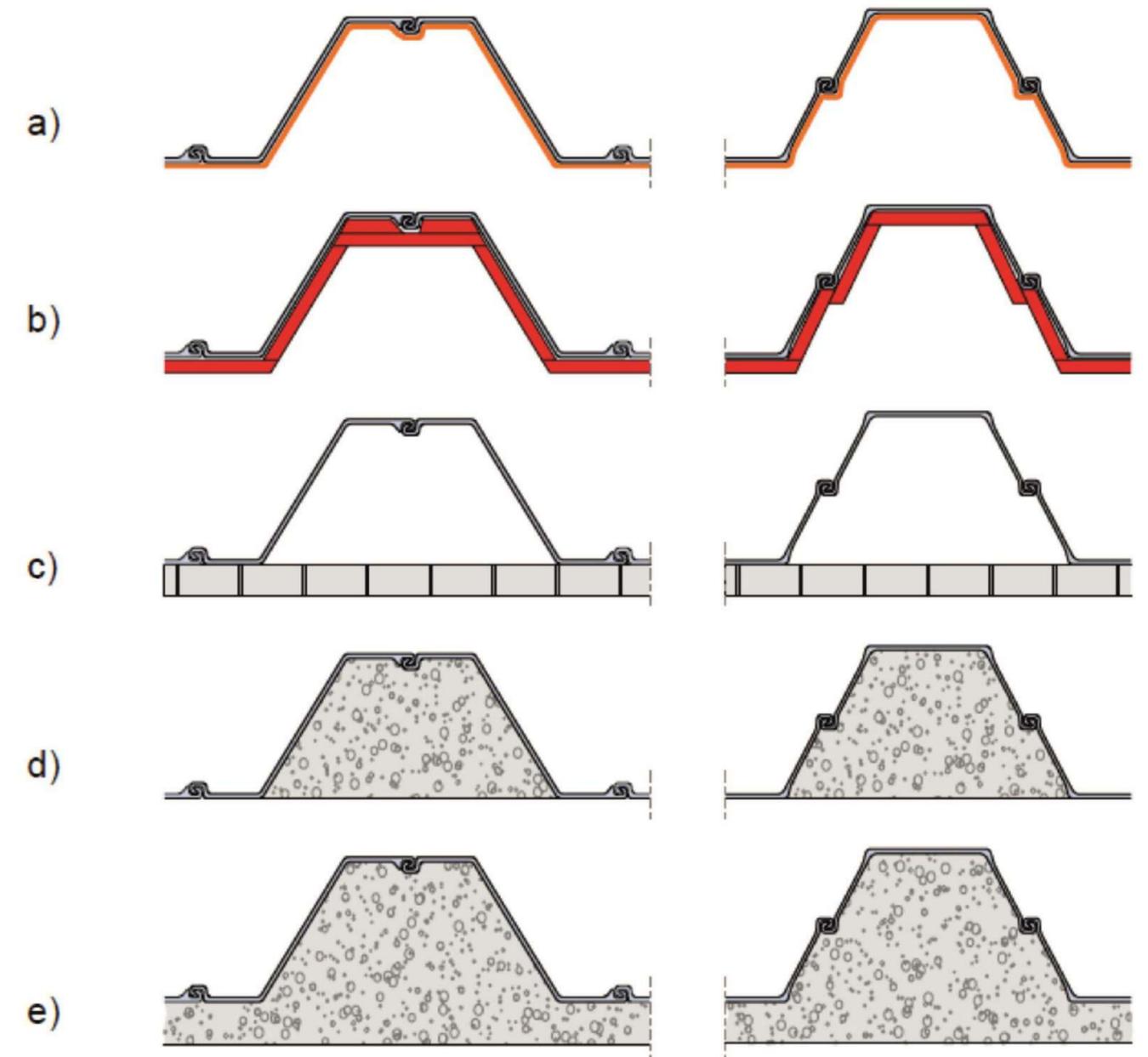
# FIRE RESISTANCE

The ultimate goal is to avoid all typical heating reactions :

Reducing the elastic limit;  
Increase elongation;  
Redistribution of bending moments and the laminate section;  
Increase of deformations.

Passive fire prevention systems :

- Application of an epoxy coating;
- Heat insulating panels;
- Masonry;
- Concrete filling;
- Complete cementation.







**Dewatering and Silent Piling** has the ability to achieve any type of project with piles, either temporary or permanent, with the most advanced machinery in the industry: vibro hammers with high frequency and variable torque, hydraulic press for static pressing and extraction of piles, without vibration and with minimal sound emissions, perfect for construction sites located in the vicinity of sensitive buildings or in residential centres.

## PILING MOUNTING TECHNOLOGIES

# DYNAMIC METHOD

The vibro hammer is the main machine used to push the piles, steel or concrete tubes, or other elements into the ground by producing vertical vibrations. Pile INSTALLATION takes place through the "weakening" of the soil, by moving adjacent soil particles, thus the dynamic weight of the vibro hammer will stab the elements into the soil.

EXTRACTION of the piles takes place through the same process, but using an excavator or a crane to gradually lift them. This method requires some observations made regarding the relationship between the way the pile is inserted and the field surrounding the site area. First of all, we have to point out that in time there has been a significant evolution of the vibro hammer technology, moving from the standard frequency to the high frequency and variable torque ones, thus eliminating all the incidents that existed using the old equipment: - Those with high frequency and variable torque produce less vibrations in the surrounding area, propagated over short distances, compared to a standard vibro hammer. - The noise level is comparable to road traffic noise.



## STATIC METHOD

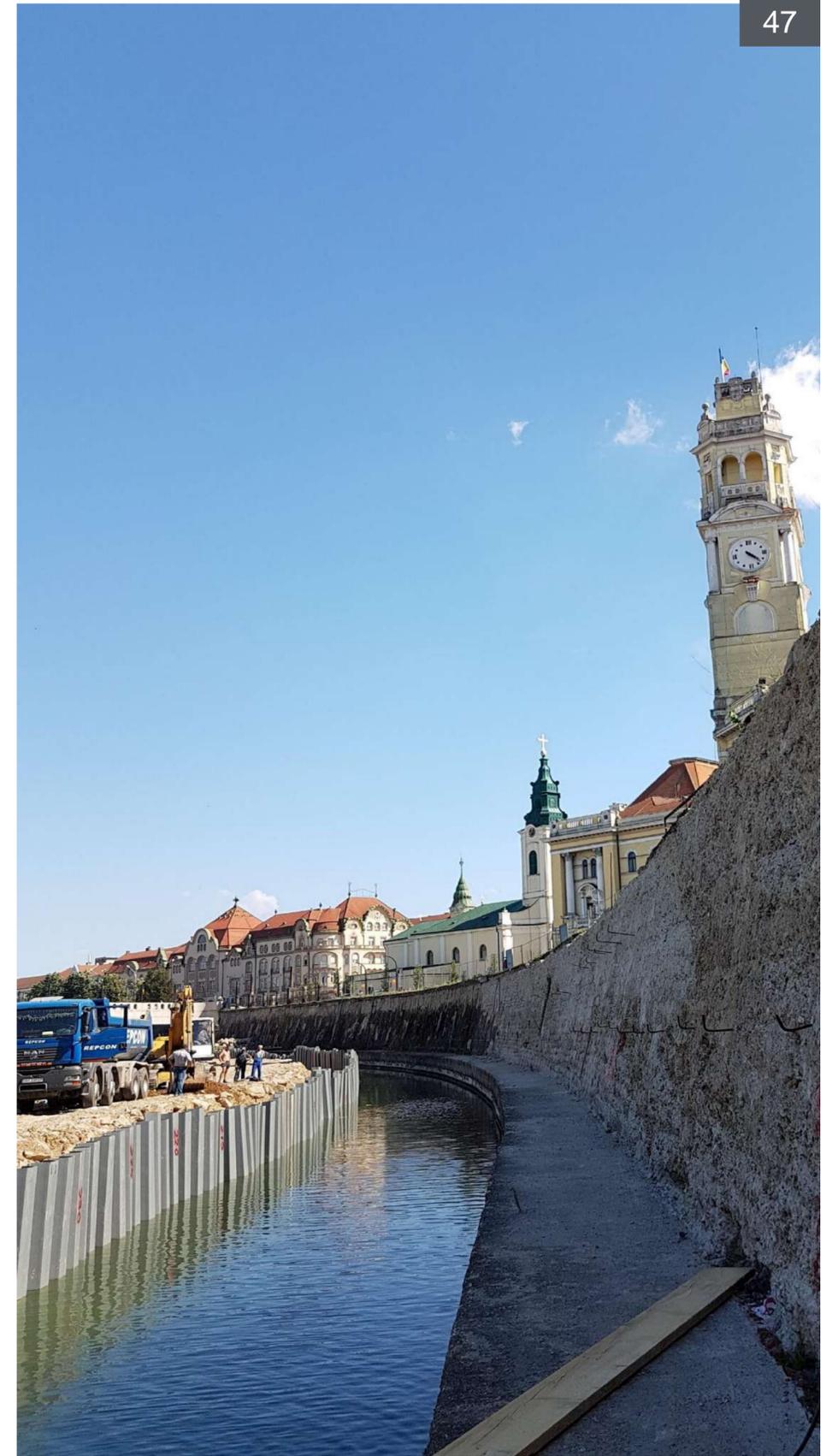
For this method, a hydraulic press consisting of the main mechanical body, the hydraulic unit and the reaction stand is used. The piles are inserted into the ground using the weight of the press and the tensile strength of the piles already in place. In the initial phase in order to

insert the first three piles, the press locks on a special stand "reaction stand", then moves independently on the three embedded piles. The lack of vibrations allows piles to be stabbed up to a distance of 500 mm from an existing structure, without the risk of damage, of equipment, installations or people near the site. This method allows the insertion of piles in



situations unimaginable in the past for designers due to vibrations, close to sensitive structures, under bridges and viaducts, tunnels, railway lines, archaeological excavations, refurbishment, in urban centres, etc. Another advantage of this method is the reduced size of this machine. Using this method, one can work anywhere because it has a low impact on the

environment. In the case of compact granular land, the press performance can be increased during the planting of the piles using a high pressure water jet so that the different layers are perforated better due to the softening of the ground; in clay soils, water serves as a lubricant to reduce lateral friction during penetration.









INDUSTRIAL AND  
COMMERCIAL  
CONSTRUCTIONS

Halls constructions in our portfolio have multiple destinations: civil, industrial and agricultural.

Depending on the requirements of functionality, image and economic aspects, we offer the most competitive solution for the design of a hall taking into account seismic and fire resistance. All our works are accompanied by all legal documents provided by the Construction Law 50/1991.

# PRECAST CONCRETE CONSTRUCTIONS

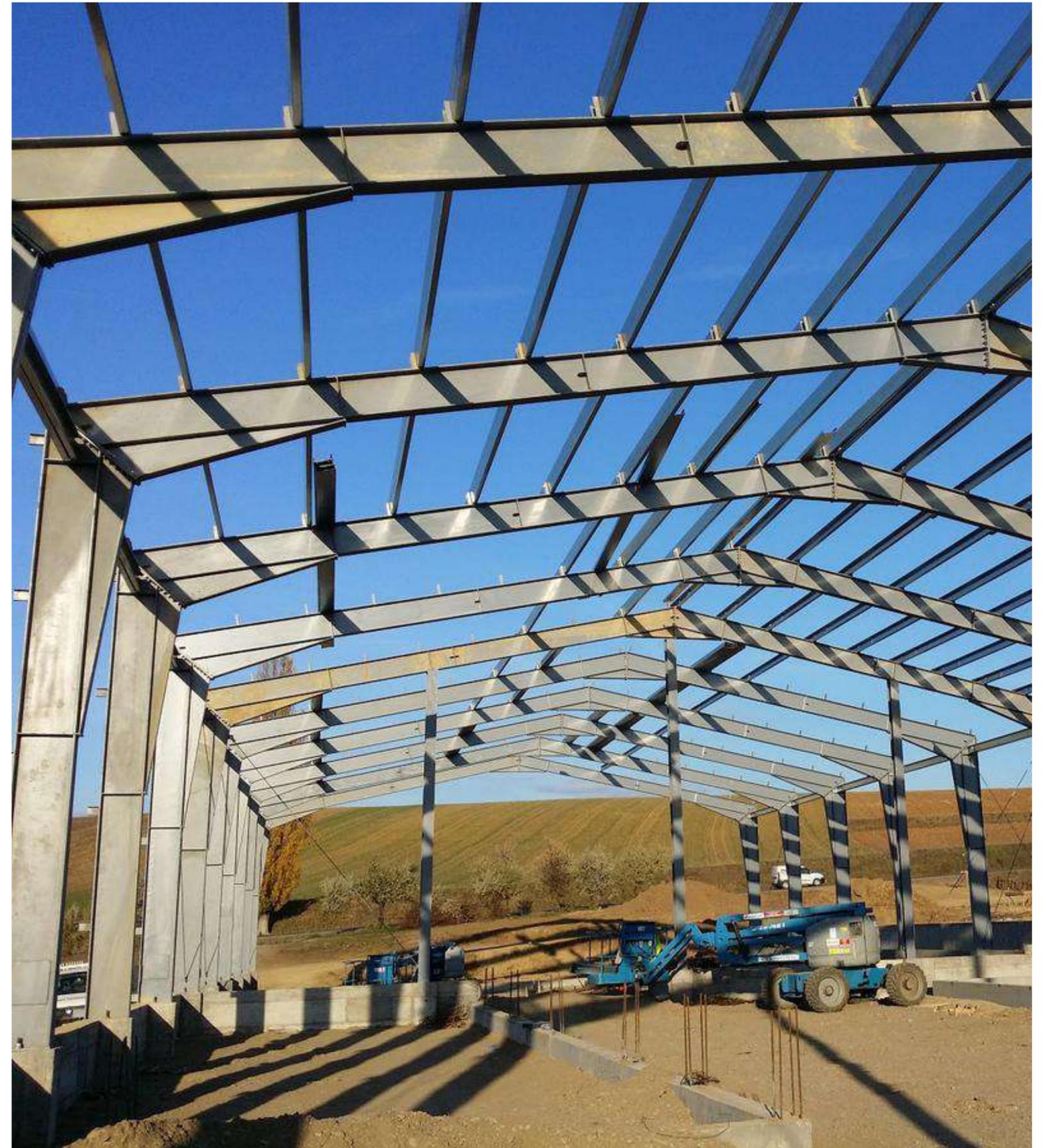
Buildings with precast concrete elements represent the optimal solution for industrial or commercial constructions, ensuring design flexibility and execution speed, using the highest quality materials certified according to European standards. They have a very high fire resistance, structural safety and durability in operation for up to 50 years without maintenance. From consulting to design and then execution, the client is assisted by a team of qualified experts. Using state-of-the-art construction technologies and equipment, support of a team of professionals and guiding ourselves to the highest quality standards qualify us as a general contractor in the most demanding projects.



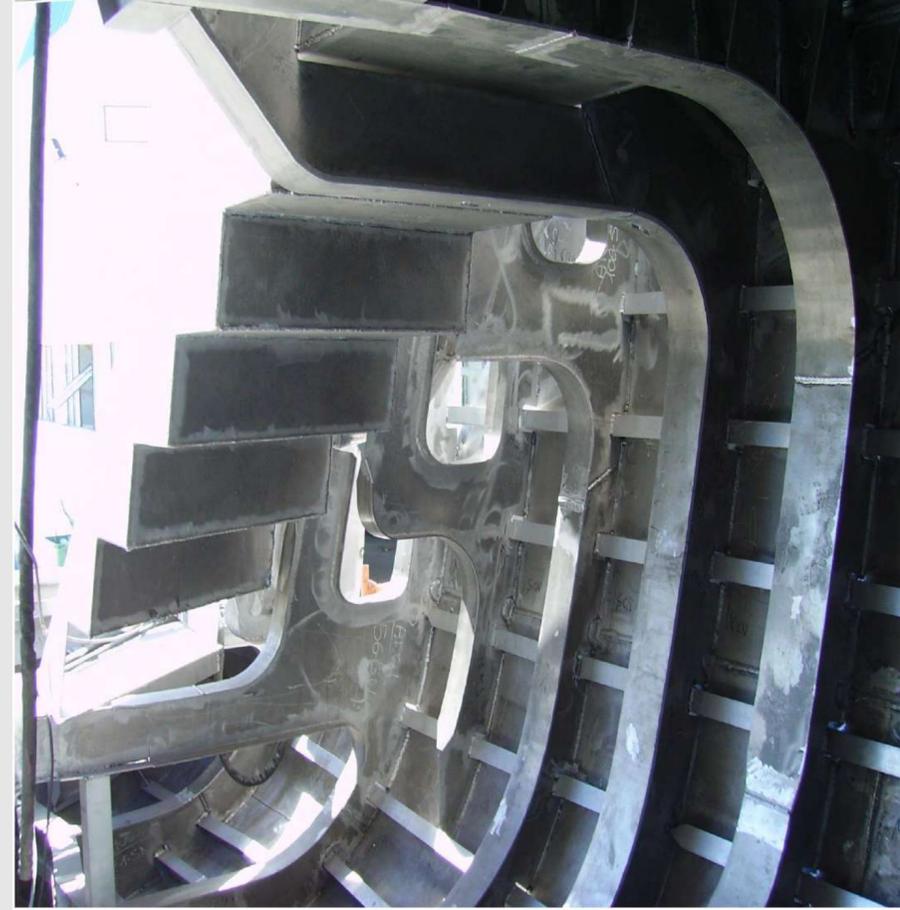
# METAL STRUCTURE CONSTRUCTIONS

Specializing in the construction of steel halls, we produce modular hall systems at costs that meet architectural aspirations. As time is a key element in the construction industry, we are always ready to offer quick and effective solutions for your ideas to become reality. Thus, the buildings with metal structure are the optimal option for fast

building of large opening buildings, which can be subsequently extended easily, having a great advantage compared to concrete ones. The buildings' robust structure is made of metallic profiles, giving the building both a light weight and easy handling. These issues ultimately lead to reduced spending and time efficiency. Regardless of the uses it addresses, commercial areas, industrial halls, offices, warehouses or showrooms, our specialist proposals meet the most demanding requirements of durability, thermal and sound insulation, safety and fire protection. The technical capacity and machines for soil improvement and stabilization enable us to build solid foundations in the most difficult terrain.







## CONTACT



25A Virgil Madgearu,  
1st District,  
Bucharest,  
Romania



[service@dewateringandpiling.com](mailto:service@dewateringandpiling.com)



+40-747-975-801