

WATERPROOFING DESIGN

*Solutions for waterproofing below ground level
and semi-basement*



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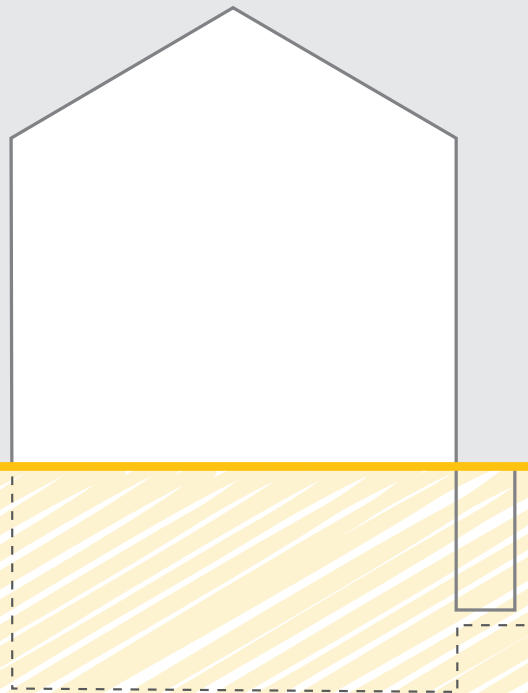
Waterproofing Design



The importance of waterproofing buildings

31% of public buildings
with basements in Italy

2-3% the cost
of waterproofing compared
to the total cost of a building

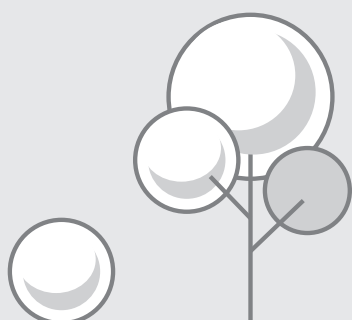


80% of construction
issues are associated with incorrect
waterproofing of which

25% are related to problems
with foundations and
basements and

7% to condensation

25% of issues in legal disputes relates to execution errors



20% of issues in legal disputes related to design defects

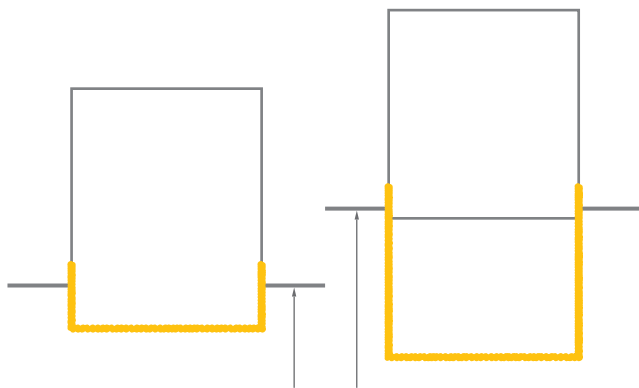
43% of private buildings with basements in Italy

20% of installers of waterproofing products have extensive knowledge of how they work

Ref. Volteco Research Centre
data referred to Italian market

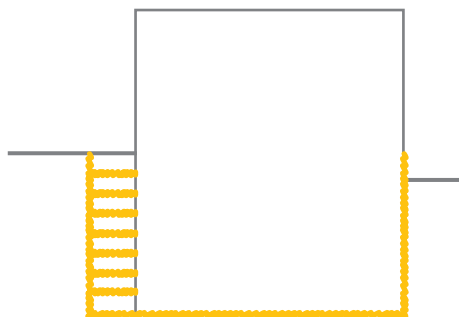
The various types of underground structures

There are many structures below ground level that are built for a variety of purposes. Every type of structure requires specific solutions to avoid unpleasant 'surprises' such as **water seepage**, **hygiene and/or humidity issues** that would affect the **liveability** and **reliability** of their intended purpose.

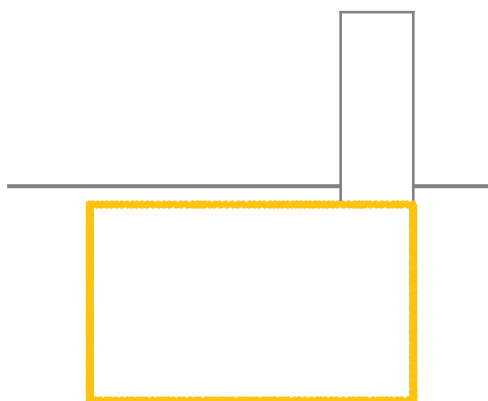


FOUNDATIONS WITH DIFFERENT LEVELS

Foundations with different levels have clear **technical issues** (different types of soil and stress, etc.) that must be carefully analysed before going ahead with the works.

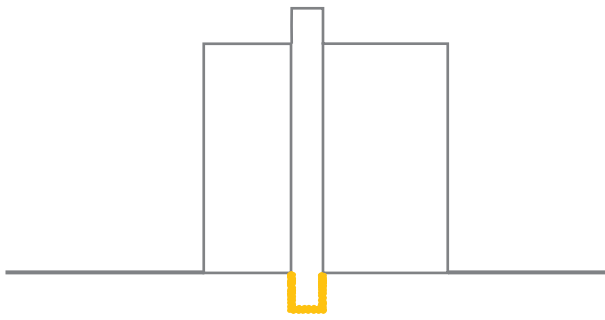


The stairs next to our structure may be a **critical point** for the infiltration of water. All weak spots must be fully **sealed** in order to avoid unpleasant inconveniences and for open air staircases there must be a **rainwater disposal system**.



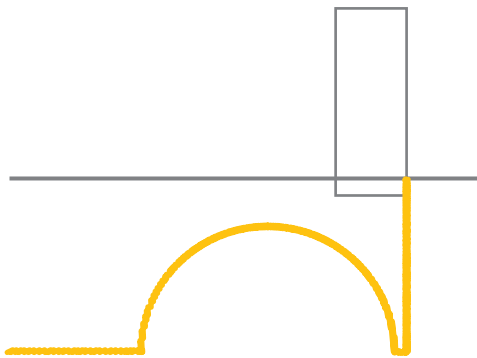
FULLY UNDERGROUND PREMISES

Car parks, cellars and fully underground premises need to be considered as boxes immersed in water, which means that the right waterproofing of choice is a **safe**, repairable and complete **system**.



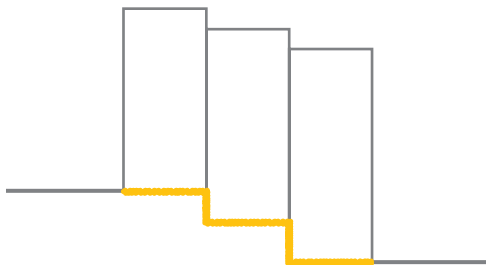
ELEVATOR PITS AND LIGHTWELLS

An elevator pit is a **technical area** and namely consists of the space under the travel shaft allowing for the overtravel of the lift, which is constantly subjected to **dynamic stress**. The lightwell is instead used to insure the **passage of air and light** through the area below ground level, and rainwater disposal systems must be put in place here as well.



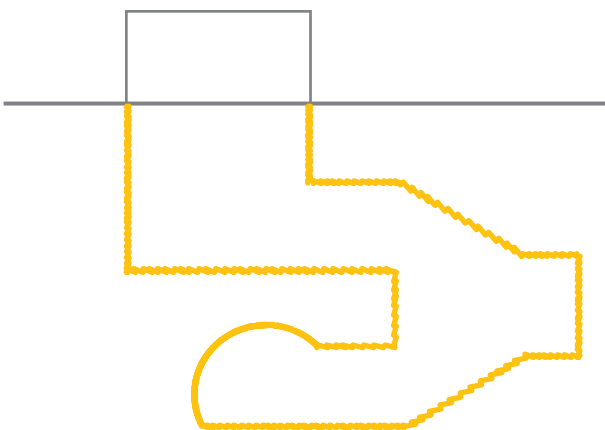
TUNNELS AND UNDERPASSES

Tunnels and underpasses consist in a roughly horizontal **perforation** in the soil, where the length – prevailing over the other two dimensions – connects two places. As well as evaluating the performance expected by the waterproof system, it is necessary to consider **integrated solutions** for technical and construction joints.



DESCENDING STRUCTURES

In this case, the upward buoyant force may vary for each underground room. It is necessary to identify a solution that guarantees the certainty of the result thanks to **continuous waterproofing** also on any **work joints**.

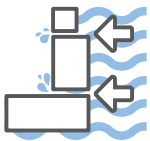


UTILITY DUCTS AND RAMPS

Connection areas and systems that connect two or more underground spaces; while they may sometimes be small, the issues of the previous types of structures still apply.

Recurring issues

As well as being stressed by their own loads, **underground structures** are stressed by **forces** such as the pressure exerted by the soil and by the water. The **water pressure** is often underestimated, as it refers to surveys that are usually carried out only in the stages prior to excavation. Moreover, the fact that the **aquifer can suddenly rise** is almost never considered as it should be, for instance with strong rain, until it reaches the ground level or even beyond in the case of floods.



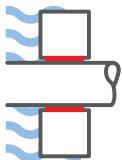
CRACKS

Commonly found in weaker areas, in changes in level or thickness; in areas subjected to greater stress the crack becomes dynamic.



CONSTRUCTION JOINTS

When concrete castings cannot be perfectly joined together, this produces potential lines where **water** may pass.



PASSING ELEMENTS

Spacers, bars, pipes: these elements encompass all the issues of **expansion joints** and **construction joints**.



EXPANSION JOINTS

Operating joints are subject to repeated movements caused by dynamic and/or variable loads, or thermal expansion.



STRUCTURAL DAMAGE

Also substantial if the structure is not suitably **designed to withstand loads**.



Level of risk according to the type of structure

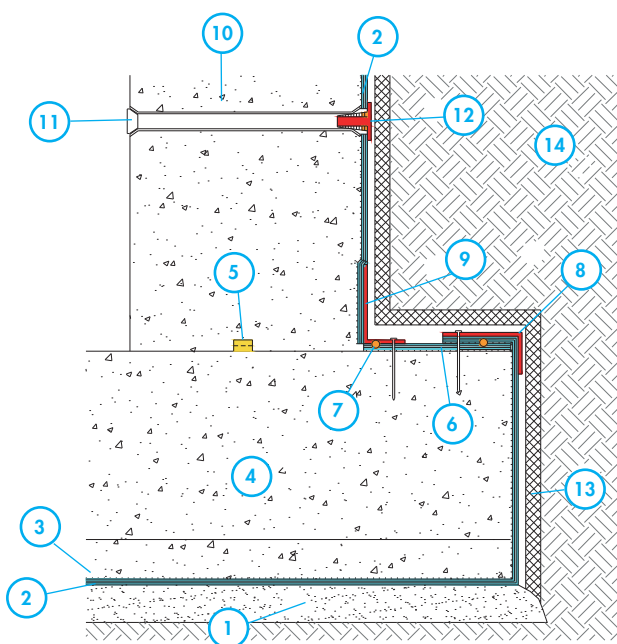
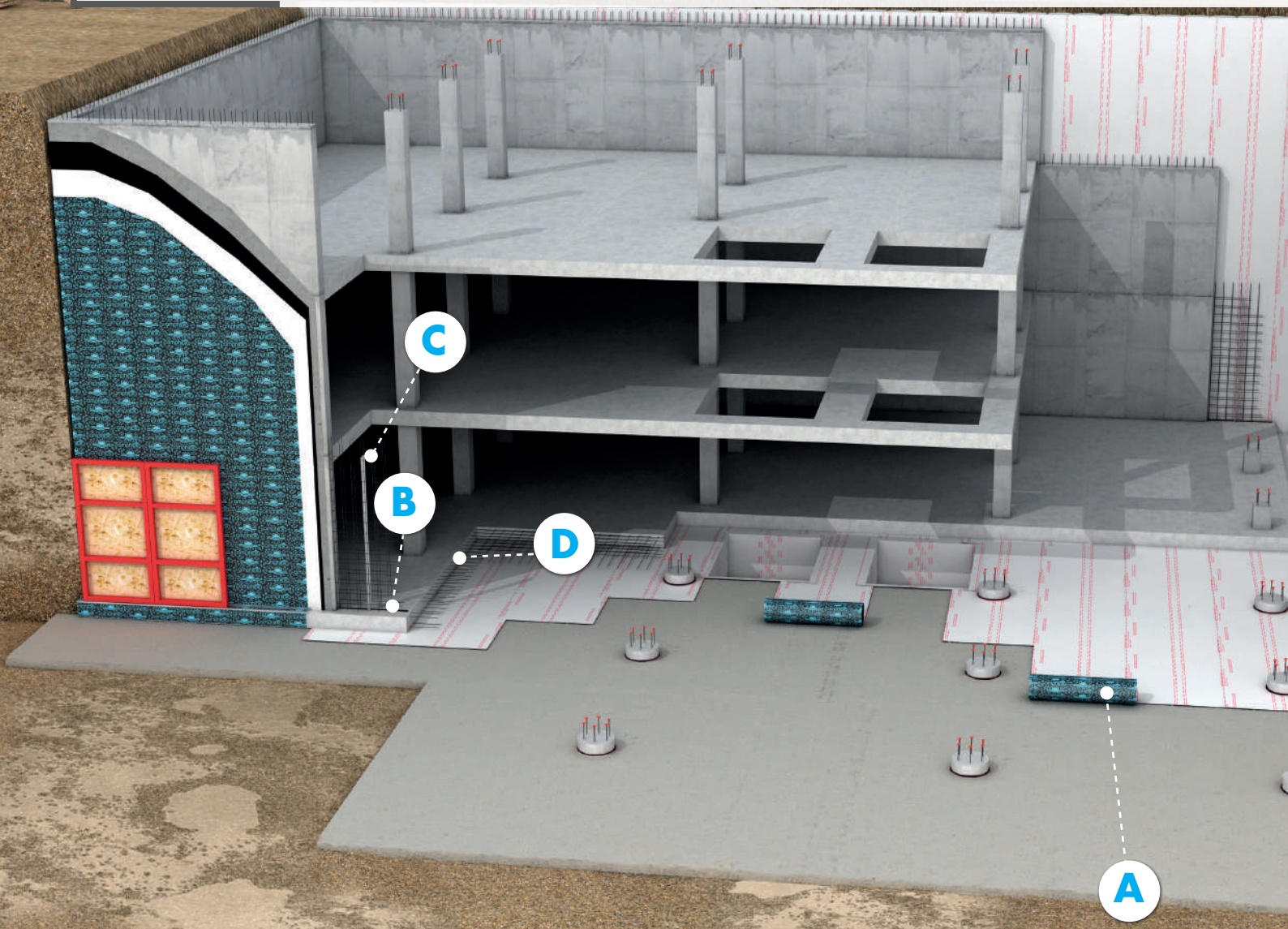
The **waterproofing** requirements of **below-ground structures**, as defined in standard **BS 8102-2022***, first of all specify that the material must be installed by **specialised operators** according to the required design. Moreover, the waterproofing must be developed according to the **risk** and **exposure to pressurised water** of the building over time and must involve suitable materials according to the function. We will now look at the division in detail depending on the **intended use** and expected **performance**.

WATERPROOFING LEVEL ACCORDING TO THE INTENDED USE	DESTINATION	 PRESENCE OF WATER/HUMIDITY	 HEALTHY ENVIRONMENT	REQUIREMENTS FOR TYPE B (Structurally integral) protection
DEGREE 1A	Non-habitable areas, car parks, rooms for utilities (excluding electrical and electronic ones).	Seepage and damp areas from internal and external sources are tolerable, where this does not impact on the proposed use of below ground structure. Internal drainage might be necessary to deal with seepage.		Tightness Class 0 (to BS EN 1992-3:2006) – the provisions in 7.3.1 of EN 1992- 1-1(5) may be adopted.
DEGREE 1B	Non-habitable areas, warehouses, manufacturing areas with indoor finishes that do not deteriorate with humidity.	No seepage. Damp areas from internal and external sources are tolerable.		Tightness Class 1 (to BS EN 1992-3:2006) – any cracks that can be expected to pass through the full thickness of the section should be limited.
DEGREE 2	Habitable areas with dry rooms and presence of people.	No seepage is acceptable. Damp areas as a result of internal air moisture/ condensation are tolerable; measures might be required to manage water vapour/ condensation.	Ventilation, dehumidification and air conditioning recommended.	Additional measures (such as a combined protection, water-resisting admixture, pre- or post-tensioning) should be used.
DEGREE 3	Habitable areas with dry rooms and presence of people. Sensitive civil and industrial areas (technical rooms, caveau, safety rooms, data center, etc)	No water ingress or damp areas (C) is acceptable. Ventilation, dehumidification or air conditioning necessary; appropriate to the intended use D).	Required	Additional measures (such as a combined protection, water-resisting admixture, pre- or post-tensioning) should be used.

For environments where the intended use and the related conditions are not clearly expressed, considering the potential consequences, we recommend observing the conditions of **Degree 3**.

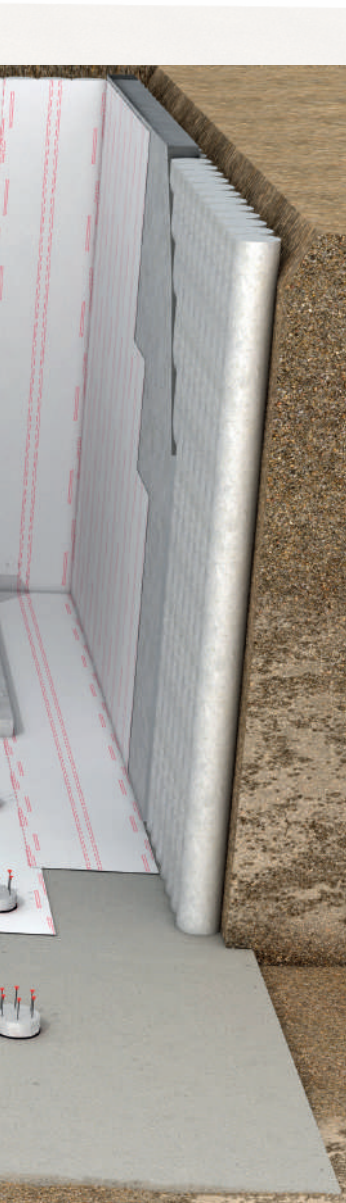
*For further details see "NHBC Standards", chapter 5.4: "Waterproofing of basements and other below ground structures" and "British Standards BS 8102 - Code of practice for protection of below ground structures against water from the ground".

Active waterproofing and total barrier



CONSTRUCTION JOINT WITH AMPHIBIA PRE-APPLIED AGAINST FORMWORKS

1. Lean concrete
2. Amphibia 3000 Grip
3. Concrete protective screed (optional)
4. RC raft foundation suitable to withstand hydraulic pressures and exempt from defects
5. WT
6. Amphibia 3000 Grip
7. Bi Mastic or Akti-Vo 201
8. Amphibia Pressure Corner 90°
9. Amphibia Pressure Corner 270° (overlapping elements)
10. RC wall suitable to withstand hydraulic pressures and exempt from defects
11. PVC distance tube to seal
12. Amphibia Stopper with Akti-Vo 201 PVC distance tube to seal
12. Rigid insulation panel or non-woven textile (min 250 g/m²)
13. Well compacted soil without voids



Triple active protection for watertight waterproofing

Amphibia is a waterproof membrane reactive to contact with water, **self-repairing, self-sealing and self-bonding** to concrete. Thanks to its innovative composition it ensures **full water-tightness** for underground structures against water seepage.

Choosing **Amphibia** means choosing top waterproofing system. The full water-tightness and long-term efficiency of the application are the main factors that determine this choice.

Products

A AMPHIBIA

Self-fastening, self-repairing and self-sealing hydro-reactive multilayer waterproof membrane for pre-cast application.



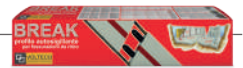
B WT CONSTRUCTION

Hydro-expansive profile based on AMPHIBIA copolymer in EPDM profile that seals concrete casting joints in reinforced concrete structures, even in the presence of strong water pressure.



C WT BREAK

Self-sealing watertight box element designed to control and seal any spontaneous cracks that develop in the reinforced concrete.



D WT EXPANSION, PANEL AND STRIP

Hydro-expansive based on AMPHIBIA copolymer in EPDM gasket that seals structural joints in all types of reinforced concrete structures, even in the presence of strong water pressure.



Protection level:

- Active waterproofing and total barrier

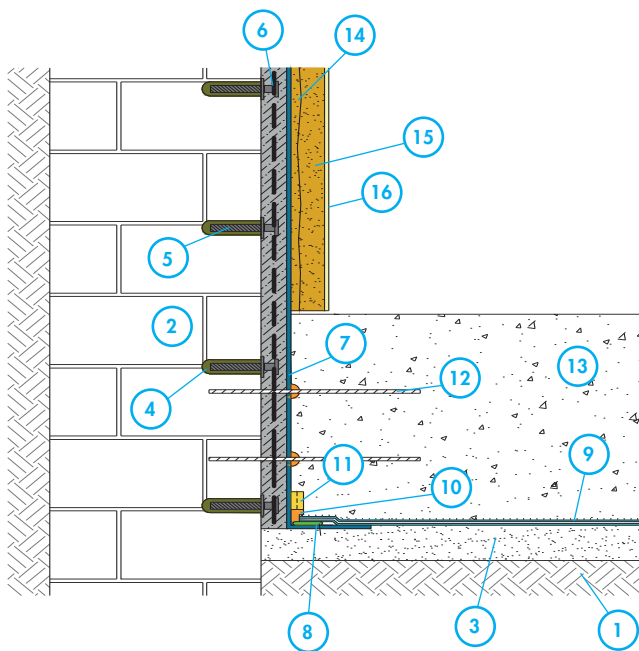
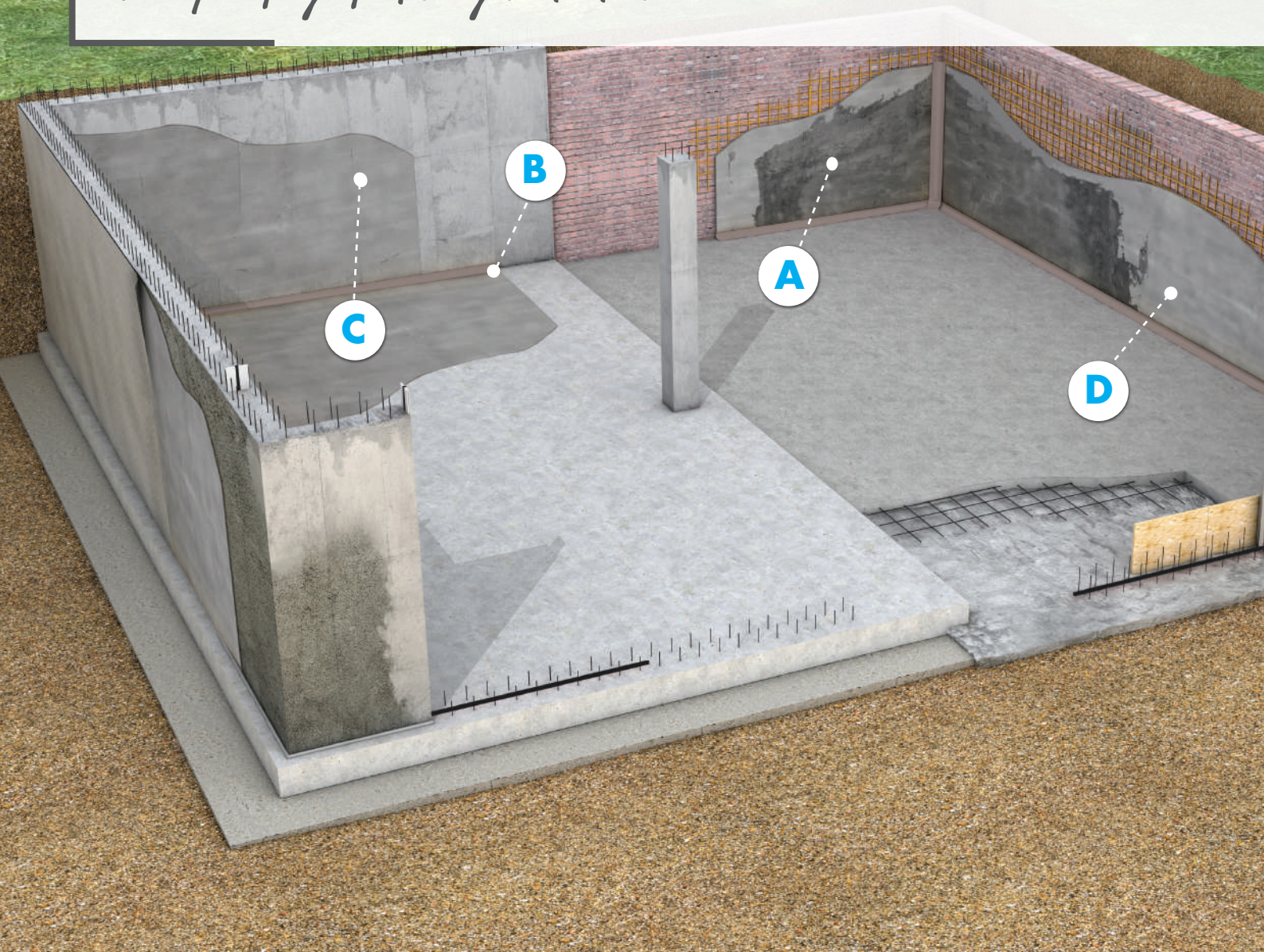
Advantages:

- Absolute waterproofing with no lateral migration of water
- Immediate mechanical protection, self-repairing also in case of accidental puncture
- High resistance to hydraulic load
- High flexibility and capacity to bridge cracks

Ambiti di applicazione:

- Waterproofing and protection of reinforced concrete structures
- Internal re-lining of existing underground structures
- Infrastructure waterproofing
- Waterproofing of underground pools and water containment tanks

Waterproofing of existing structures



INTERNAL RETROFIT WATERPROOFING WITH BRICK MASONRY

1. Soil
2. Existing masonry structure suitable to withstand hydraulic pressures and exempt from defects
3. Lean concrete
4. Bi Fix
5. Connettore 20
6. Bi Mortar Plaster Seal embending Revomat or a stainless steel net, fastenet to masonry, according to the Designer's prescriptions
7. Plastivo
8. Bi Mastic
9. Amphibia 3000 Grip
10. Akti-vo 201
11. WT
12. Connectors sealed with Akti-vo 201
13. RC structure suitable to withstand hydraulic pressures and exempt from defects
14. Calibro Rinzafo
15. Calibro P.E. Intonaco
16. X-Lime



Fully watertight remedial waterproofing of existing buildings

The combined action of solutions exclusively designed to solve the damage caused by **humidity** and **water seepage** in underground premises and semi-basement can permanently solve incorrect or absent waterproofing, also if there is a high aquifer and substantial rising damp.

Bi Flex System, Calibro System, Bi Mortar Family and the Plastivo range coexist in our underground structure to ensure **health** and **well-being**.

Products and solutions

A BI MORTAR FAMILY

Four products that provide a mix of solutions for fast intervention aimed at providing complete waterproofing. Simple to use and multipurpose, they guarantee excellent waterproofing and high mechanical performance even with negative hydraulic pressure.



B BI FLEX SYSTEM

It is a combination of waterproof elements to treat joints and cracks. It consists of a TPE polymer-based elastic tape and a two-component epoxy adhesive.



C PLASTIVO

Waterproof coating featuring high elasticity and versatility of use to waterproof surfaces subject to positive and negative hydrostatic pressure.



D SISTEMA CALIBRO

Dehumidifying system formulated to restore plaster on damp walls, both indoors and outdoors. It is comprised of two restoring, dehumidifying components, CALIBRO RINZAFFO and CALIBRO P.E. INTONACO, to be used one after the other.



Protection level:

- Thin waterproofing and elastic protection either inside or outside.

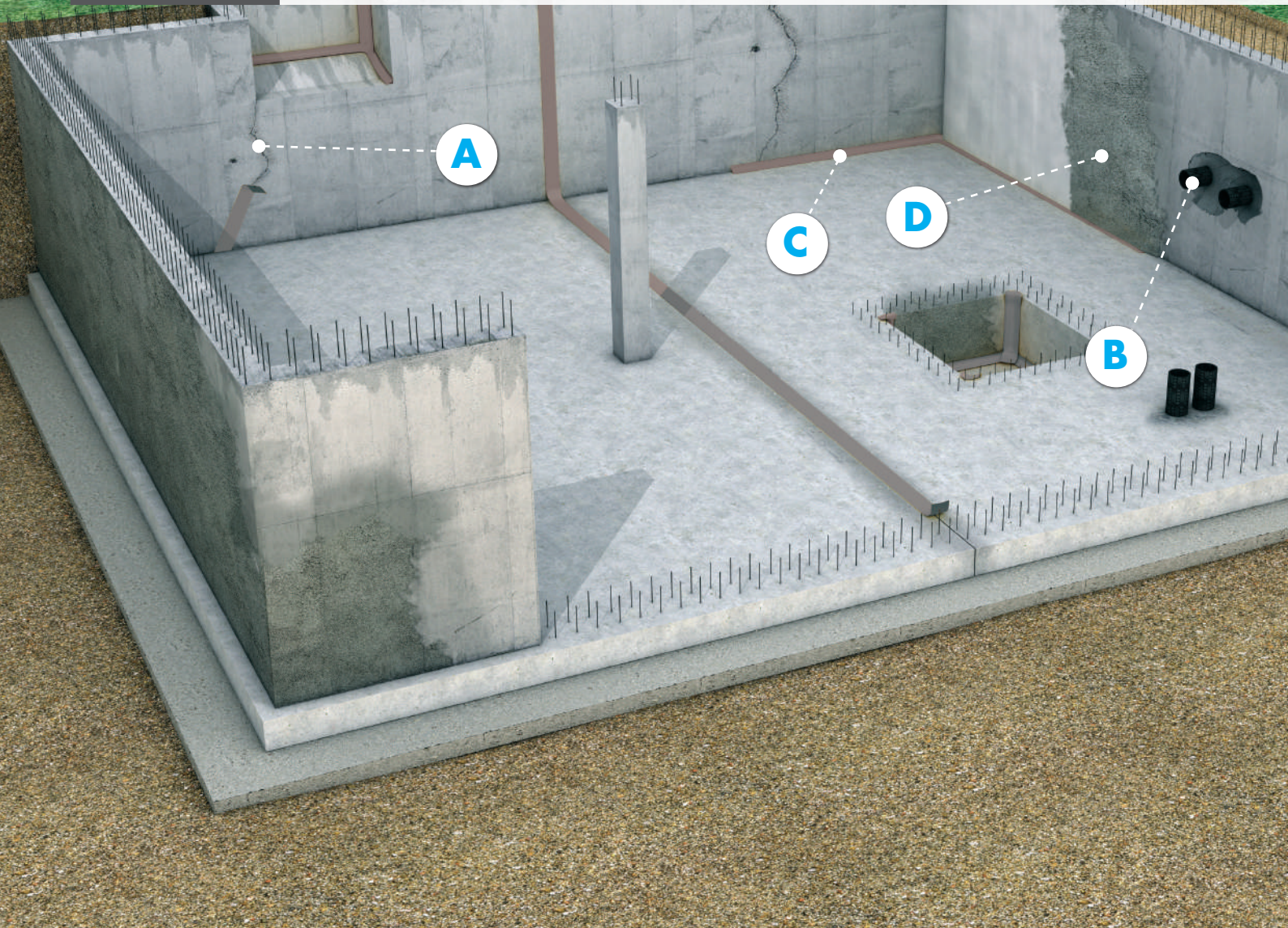
Advantages:

- Excellent adhesion
- Versatility and adaptability of solutions
- Resistant to negative and positive hydrostatic pressure

Field of application:

- Below ground underground structures in general

Localised post-casting sealing and combined protection with waterproof

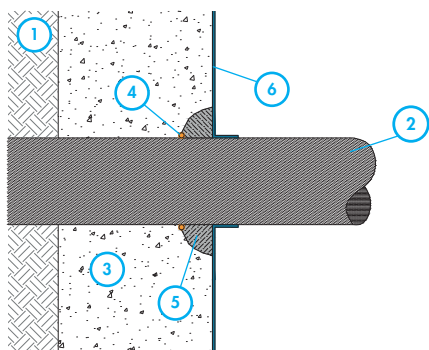
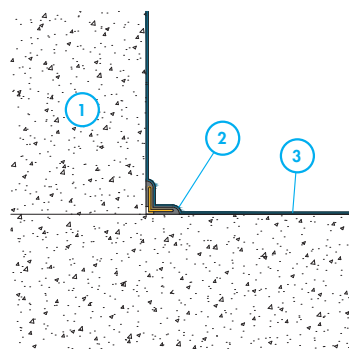


COLD JOINT INTERNAL SEALING WITH PLASTIVO AND BI FLEX SYSTEM

1. Existing RCC structure designed to withstand hydraulic pressure and exempt from defects
2. Bi Flex System
3. Plastivo

PENETRATION SEALING WITH AKTI-VO 201 AFTER POURING CONCRETE

1. Soil
2. Penetration
3. RC structure suitable to withstand hydraulic pressure and exempt from defects
4. AKTI-VO 201
5. I-PLUG
6. PLASTIVO



It's a waterproof life.



Accurate solutions that can be combined together for a full refurbishment, even at a later stage

The combined use of the **Bi Flex System** on joints and cracks (which cause water seepage and leaks) and waterproof and flexible coatings of **Plastivo**, allows for smoothing and waterproofing, to ensure a permanent and long-lasting refurbishment of our building, even with **pressurised water**.

Products and solutions

A AKTI-VO 201

High-performance hydro-expansive mastic for definitively sealing and waterproofing penetrations and cracks in general. Allows you to intervene directly on the inflow point.



B I-PLUG

Ultra-quick setting waterproof mortar, ideal for immediately closing water leaks.



C BI FLEX SYSTEM

A combination of waterproof elements to treat joints and cracks. It consists of an elastomeric terpolymer-based elastic tape and a two-component epoxy adhesive.



WATERPROOFING

D PLASTIVO

Waterproofing products suitable both in case of negative and positive water pressure, they provide a continuous coating on concrete surfaces and masonry.



Protection level:

- Protection and waterproofing inside or outside
- with control over joints and cracks

Advantages:

- Rapid application
- Coatings, including thick ones
- Resistance both to negative and positive water pressure
- Structure compartmentation

Field of application:

- Retaining walls
- Underground structures
- Prefabricated elements

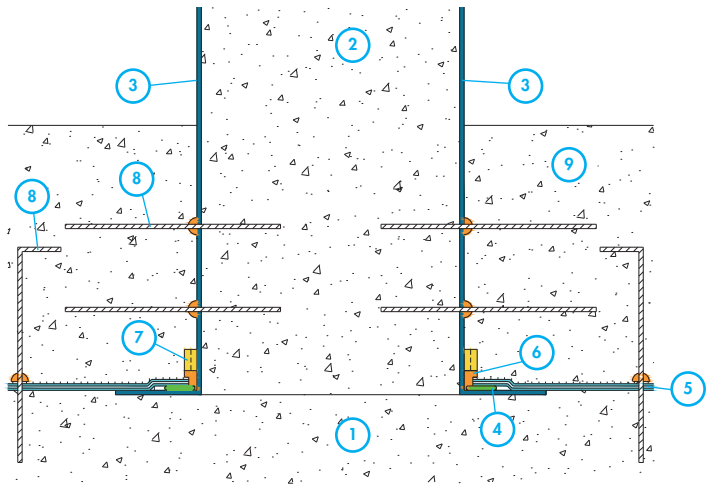
Environment redevelopment - Amphibia's pluses

Anchoring system

Thanks to **Amphibia's** technology, less than 2 mm of pure potential energy confined to guarantee full water-tightness, thin foundation beds with hydrostatic properties can be created. **Amphibia** can be applied directly on lean concrete or on a previous foundation bed to be waterproofed and, thanks to its **self-repairing** properties, it can be perforated with the reinforcement bars with no performance issues. This feature allows for the **connection of new reinforced concrete structures** with existing ones, therefore offering design engineers the chance to **minimise the thickness** of the new structures according to the hydraulic stress they will be subjected to, with obvious advantages in terms of costs and volume measurements..



- 1. Existing RC structure
- 2. Existing RC pillar
- 3. Plastivo
- 4. Bi Mastic
- 5. Amphibia 3000 Grip
- 6. Akti-Vo 201
- 7. Wt
- 8. Connectors sealed with Akti-Vo 201
- 9. New RC structure suitable to withstand hydraulic pressures and exempt from defects



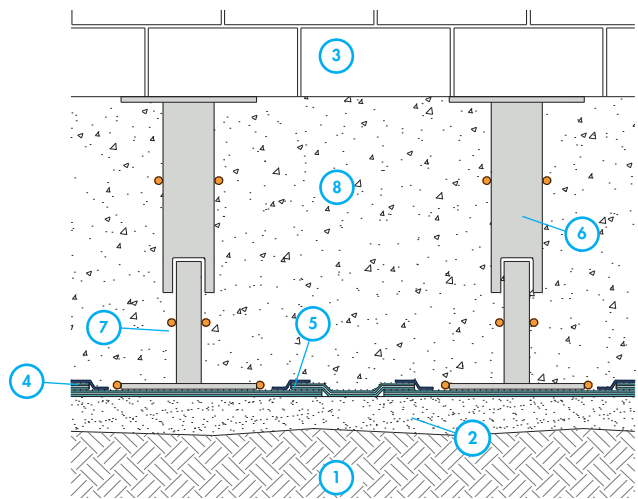
Underpinning

By choosing **Amphibia**, it is possible to waterproof underground structures even if there are partition walls, whilst retaining the waterproofing continuity, which is an essential condition to avoid compromising the successful completion of the work.

The image sums up the highly specialised intervention, where by sectioning the wall horizontally it is possible **to waterproof the foundations** continuously and without affecting the tightness. Any chance of seepage is avoided thanks to the self-sealing property of overlaps and the suitable **Safety Tape**, installed to avoid any chance of intrusion of the concrete casting between the edges of the waterproofing sheets.



- 1. Soil
- 2. Lean concrete
- 3. Existing masonry structure
- 4. Amphibia 3000 Grip
- 5. Amphibia Safety Tape o Bi Mastic
- 6. Disposable Jack
- 7. Akti-Vo 201
- 8. New RC structure suitable to withstand hydraulic pressures and exempt from defects



Masonry of a listed building

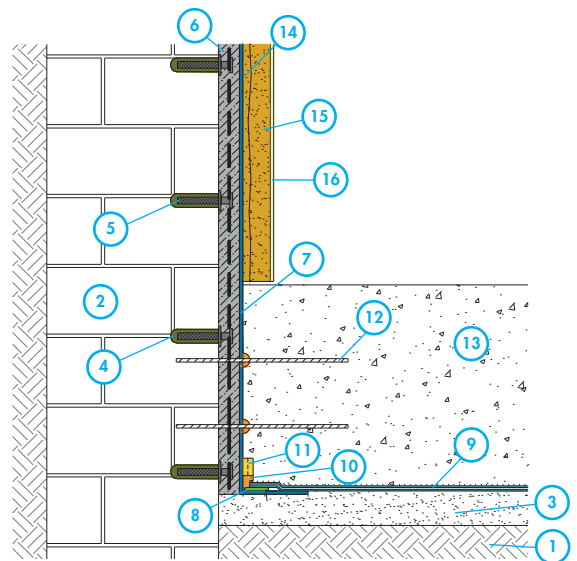
When renovating an underground structure, a common situation is the **masonry of a listed building** in stone, brick, tuff, etc.

In this case, it is essential to identify a versatile and fully watertight solution, especially where the horizontal and vertical planes are joined.

This can all be done with **Amphibia** and the **Bi Mortar** family, also in extreme situations with substantial groundwater and/or many metres below ground level.



- | | |
|--|--|
| 1. Soil | 7. Plastico |
| 2. Existing masonry structure suitable to withstand hydraulic pressures and exempt from defects | 8. Bi Mastic |
| 3. Lean concrete | 9. Amphibia 3000 Grip |
| 4. Bi Fix 300 | 10. Akti-Vo 201 |
| 5. Connettore 20 | 11. WT |
| 6. Bi Mortar Plaster Seal embending Revomat or a stainless steel net, fastened to masonry, according to the Designer's prescriptions | 12. Connectors sealed with Akti-vo 201 |
| | 13. RC structure suitable to withstand hydraulic pressures and exempt from defects |
| | 14. Calibro Rinzafo |
| | 15. Calibro P.E. Intonaco |
| | 16. X-Lime |

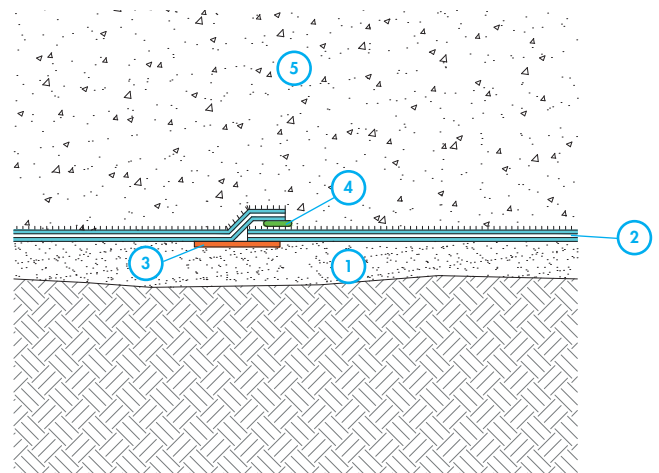


Gas protection

Nowadays ventilated loose stone foundations are often used to dispose of humidity and radon in underground environments and basements. In order to be effective, it needs to trigger a suitable stack effect. The limits of this system are often the lack of availability of north/south fronts and the presence of the foundation structures that generate narrow passages. While indeed the formation of condensation in loose stone foundations is accepted due to insufficient or uneven ventilation, for obvious reasons this is not acceptable for disposing of radon. It will therefore be necessary to provide for a forced aspiration with the installation of detectors. **Amphibia** is the solution that offers greater safety by guaranteeing a dry and protected structure also in case of underpinning.



- | | |
|-----------------------|--|
| 1. Lean concrete | 5. RC wall suitable to withstand hydraulic pressures and exempt from defects |
| 2. Amphibia 3000 Grip | |
| 3. Amphibia Lap Seal | |
| 4. Bi Mastic | |



The players in the building process

There are many **professionals** coming into play in the **building process**. Each one of them influences the final decisions taken on site and they vary in importance depending on the specific circumstances.



CLIENT

Provides a full picture of the general requirements and defines any specific needs.



DESIGN ENGINEER

Draws up the project in order to meet the client's needs and is responsible for the decisions made in terms of design.



GEOLOGIST

Carries out hydrogeological and geotechnical surveys to be enclosed with the project.



PLANT ENGINEER

Carries out the part of the project dedicated to construction site systems and building systems.



STRUCTURAL ENGINEER

Carries out the structural analysis of the building, defining, among other things, the construction techniques, service life and maintenance.



SITE ENGINEER

Ensures the technical specifications are applied, is present on site and performs quality checks on products and tests when the works are completed.



CONTRACTOR/SITE MANAGER

This is the company appointed to perform a specific job or the works in general. The person who coordinates all the construction stages on behalf of the contractor.



APPLICATOR

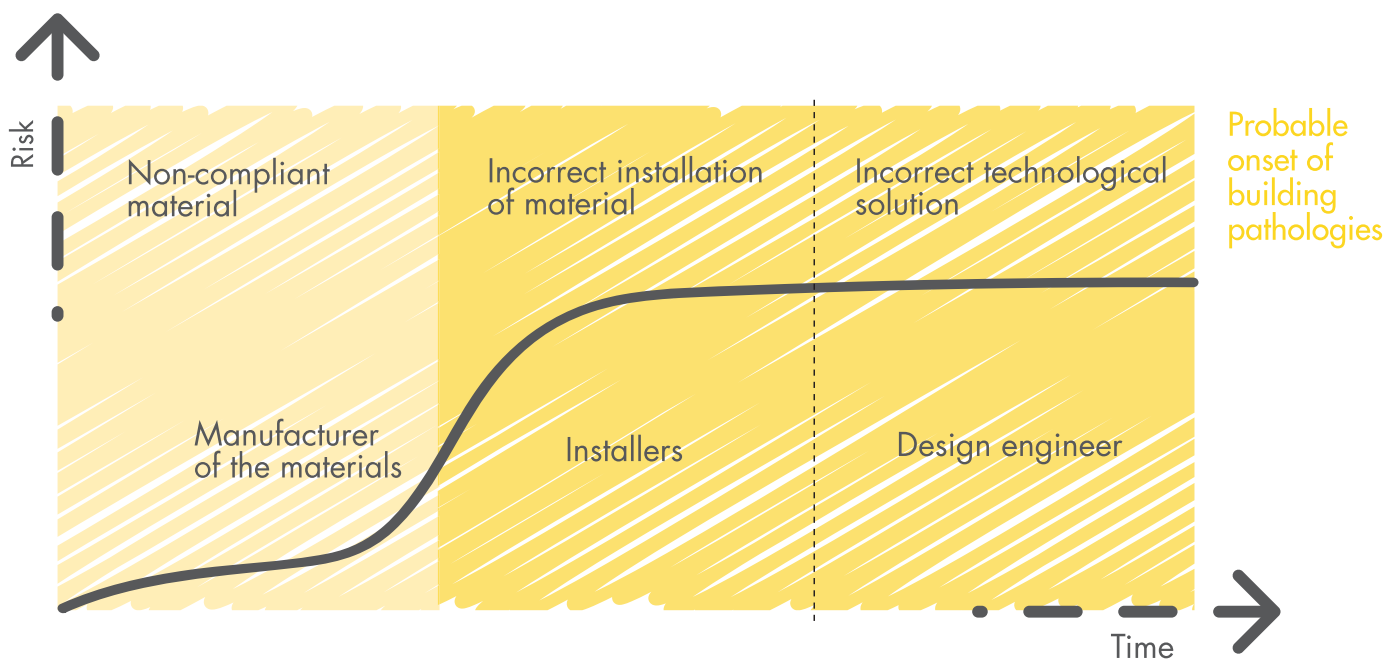
Carries out the specifications of the design engineer, assesses whether the proposed solution is suitable for use, reports any shortcomings and discrepancies.



DESIGN

A fundamental role for the technological choice of long-standing waterproofing

The likelihood of the onset of building pathologies is time-related, with gradually increasing risks. It is clear that to create a **work of art** each figure plays a unique and fundamental role.



The construction setting

Based on the requests received and by verifying the available setting in terms of lot zoned for construction, one can outline the first useful elements to examine the **building area**. Indeed, having to work right in the old town centre is very different from working in the open country, both in terms of site organisation and for the temporary support structures needed. In turn, the **physical location** of the place adds more conditioning factors.

COUNTRYSIDE



- Plenty of space available for building sites and excavations;
- No underground utilities;
- Possibility of eliminating sewage and groundwater.

CITY



- Lack of space and need to erect the building by using it as the single base for the site;
- Numerous underground utilities, possibly underpasses and undergrounds, the presence of very tall surrounding buildings, possibility of setting up anchors/tie rods in adjacent properties;
- Water supply in sewerage system or canals with relative technical (flowrates) and legal feasibility verifications (municipal authorisations).

INDUSTRIAL AREA



- Need to build over the whole area and relative organisation of the building site;
- Presence of underground utilities and verification of easement rights for any future system-related expenses of adjacent allotments;
- Presence and capacity of the sewage systems and their possible division between sewage and waste water.

FLATLAND



- Available space;
- According to the location in the countryside, in the city or in an industrial area in line with the previous details;
- Aquifer management according to the season (rainy season, rainfall...).

COAST



- Lack of space and various difficulties. The schedule and start time of the building site must be assessed and programmed also according to periods when it needs to be closed (depending on the season);
- Numerous underground utilities and possible underpasses, along with the issues mentioned for city centres;
- Influence of tides and basin water levels (lakes, rivers...) on the aquifers.

MOUNTAINS



- Little space and various difficulties, also in relation to the ground level inclination and the road network layout;
- Need to stabilise the ground both in the building site and in broader areas.
- Chance of slope and drainage of water if across a hillside or mountainside or at the top with maximum attention to reservoir criticalities for valley floors, especially in mid seasons.
- Start and end of the works to be assessed according to the season and climate.

Building on different types of soil

Thorough knowledge of the **soil** is important both for the bearing capacity and stability of the buildings, also for the purposes of creating the building site itself.



SILTY - CLAY SOIL

Soil featuring the opportunity for accurate verification both in draining and saturated conditions. Possibility of inserting various types of temporary support structures, such as slurry walls, retaining walls with and without tie rods (only if there is no constant groundwater), metal sheet pile retaining walls and jet grouting columns. In terms of water control, there is the risk of **standing water** due to the **poor drainage capacity**. We recommend using horizontal and vertical drainage systems, along with wells.



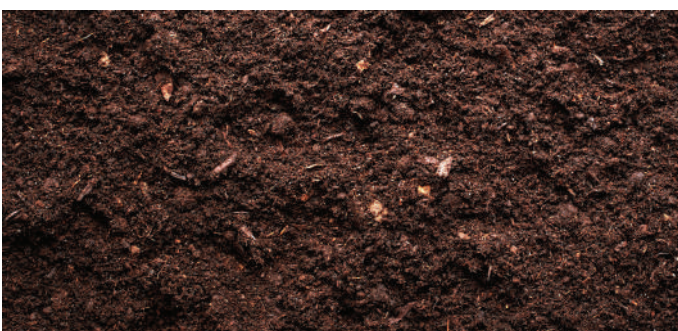
SANDY SOIL

Soil generally featuring a **good bearing capacity** with poor stability of slopes. Recommended temporary support structures: slurry walls, metal sheet pile retaining walls, prefabricated reinforced concrete sheet pile retaining walls and jet grouting columns. Usually excellent **drainage** with the need for pumping filters; with this type of soil wellpoint systems can be adopted.



GRAVELLY SOIL

Soil with **excellent stability**, but with difficulties in terms of construction. Given the type of soil, not all temporary support structures can be used. We recommend using slurry walls, retaining walls with and without tie rods (only if there is no constant groundwater) and jet grouting columns. As for water, pay attention to high flowrates due to **rainfall** or if there is a **thick aquifer**.



BACKFILLING

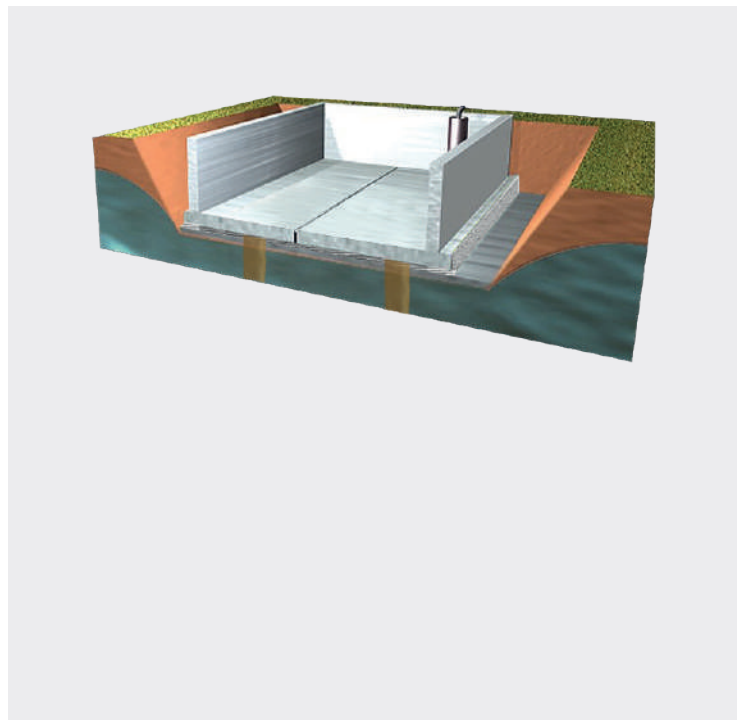
Type of soil used especially in the field of building recovery field. The most recommended temporary support structures are slurry walls, retaining walls with and without tie rods (only if there is no constant groundwater) and jet grouting columns. The presence of **suspended groundwater** is the main element to be analysed and great attention must also be given to the **frequency of industrial pumping**.

Excavation and construction procedures

Creating an **underground structure** is not an easy task, especially in congested urban areas and/or featuring different developments both from a historical-artistic point of view and in terms of town planning. **The type and depth of the excavation**, together with the type of building to be created also influence the choice and installation of the waterproofing system. These aspects must be taken into consideration in the initial **design stage** in order to plan enough **excavations** and all the necessary **temporary support structures**.

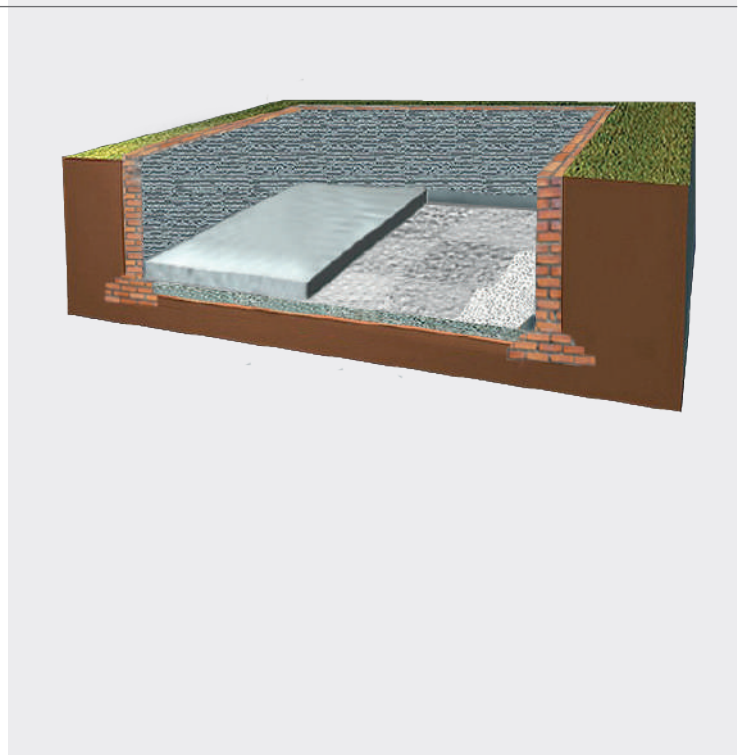
OPEN-CAST EXCAVATIONS

This excavation technique is based on the internal friction of the ground and requires a lot of space if the ground has a poor bearing capacity. Traditionally economical, it allows for a bottom-up construction method with no restrictions in the choice of waterproofing system.



INTERNAL EXCAVATION - RELINING

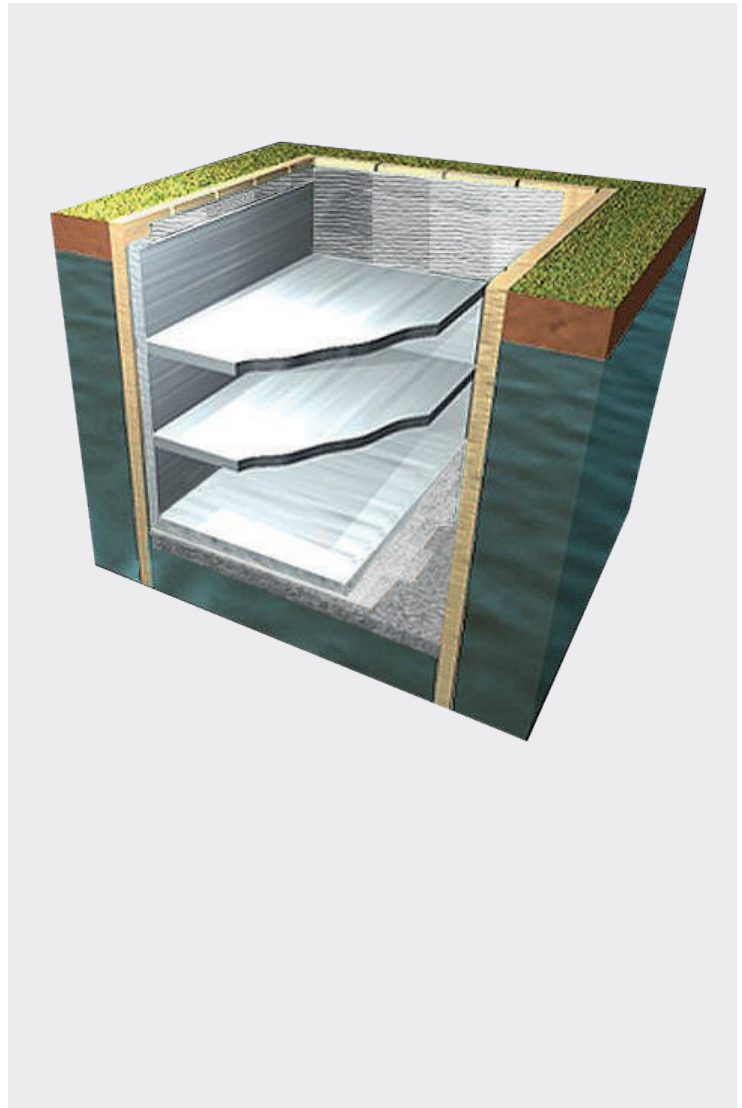
In case of structures below ground level with water seepage or moisture issues, one can intervene with the so-called technical term "re-lining". It is essential to remove all indoor superstructures (plaster, floors, etc.), so that the waterproof system is applied directly in contact with the reinforced concrete structures designed to withstand the hydraulic pressure. The indoor waterproof lining can be made with thick waterproof plaster, suitably anchored with plugs and steel mesh to distribute the load, with elastic covers or with hydroexpansive waterproof membranes.



EXCAVATION AGAINST TEMPORARY SUPPORT STRUCTURES (BOTTOM UP)

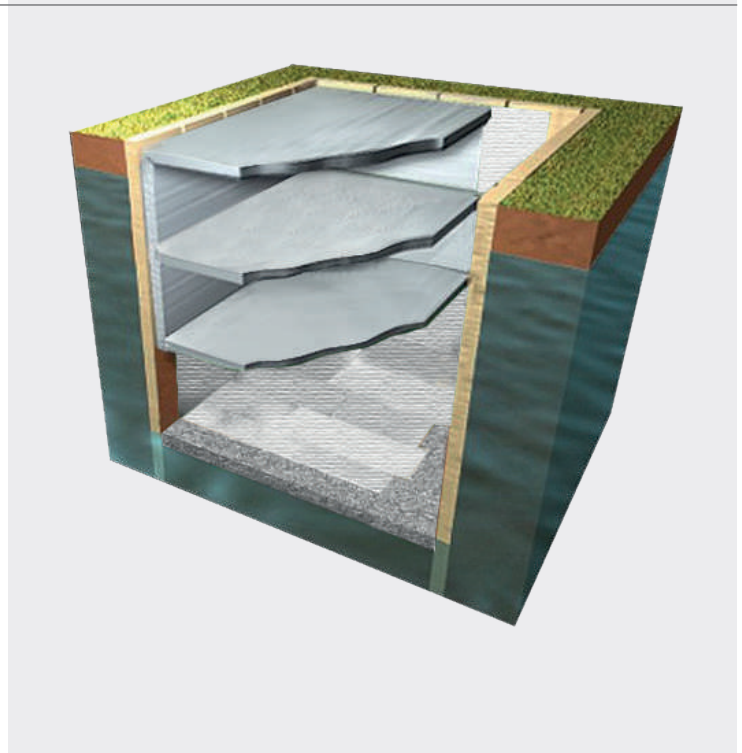
Temporary support structures can therefore be defined as temporary land support structures that, in part, keep water away (some of which is disposed of, while some can be recovered) and the most common ones are:

- **Slurry wall:** reinforced concrete retaining walls are created by using an excavation with a narrow section of land as formwork. Whilst it is not entirely watertight, this is considered the best in terms of soil containing and water flowrate reduction.
- **Retaining wall:** this is used to retain the excavation edge by creating piles driven in or drilled into the soil at a suitable centre distance according to the type of soil. Single piles can also be used under the foundations to improve their bearing capacity.
- **Sheet pile retaining walls:** sequences of sheet pile retaining walls are created to act as a barrier jammed at a greater depth than the excavation. This can only be carried out in areas where the soil allows for mechanical penetration and therefore with no rocks at a depth and elements preventing this operation. They can be either permanent or temporary, according to the internal works envisaged for the underground structure. The metal shape is a flat or U-shaped (the one most commonly used) for greater resistance to torsion. alla torsione.



EXCAVATION AGAINST SLURRY WALLS (TOP DOWN)

In complex urban areas from an historical-artistic point of view and in terms of town planning, where the excavation is very close to existing buildings, the top-down method can be adopted by using, for the excavation, the protection of the reinforced concrete floor acting as a covering. From an operational point of view, the execution of the works starts with the creation of the slurry walls forming the outer walls of a large reinforced concrete box: this way, the soil around the excavation can be contained, preventing it from falling inside. The waterproofing can then be laid on the temporary support structures, which have been suitably rectified and the reinforced concrete structures of the underground building can be carried out.



Before & after

Cellars and garages



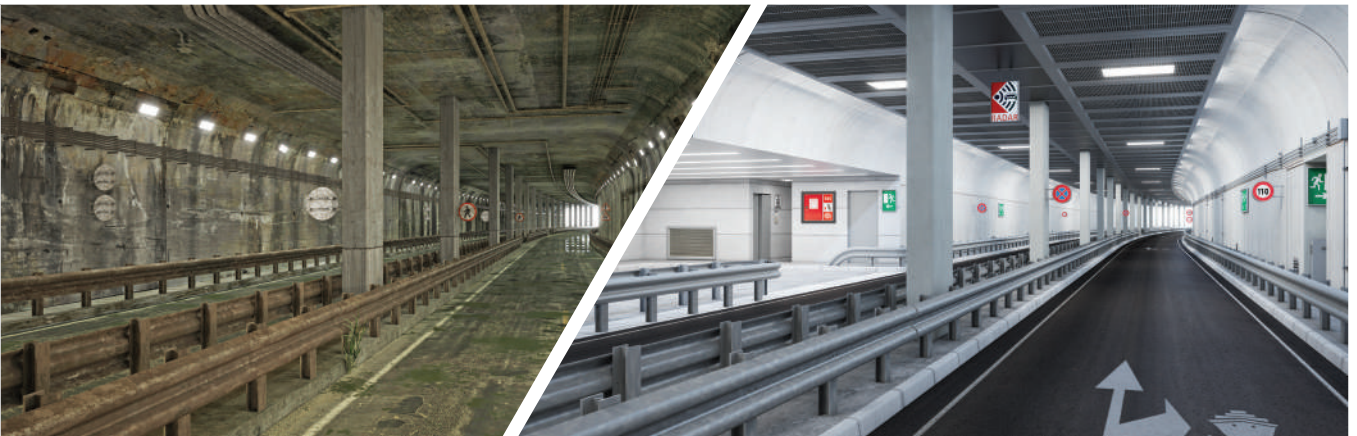
Multilevel car parks



Listed buildings



Tunnels and underpasses



Tailor-made Volteco is a project completely dedicated to the world of **design**! It's a preferential route to turn to for advice on your immediate and personalized waterproofing and water containment problems. Whatever it is your water problem, our Technical Team is at your disposal!

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Practical and technical insights



Real-time design support



Fulfillment in the building site

Technical drawings BIM

Download all waterproofing technical drawings in BIM format provided by our technical office.

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VOLTECO: *the ideal partner for waterproofing*

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BIM
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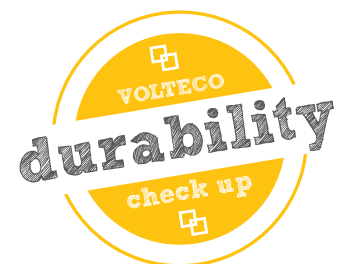
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professionals
and installers**



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COMPANY CERTIFIED MANAGEMENT SYSTEM QUALITY - ISO
9001 - ENVIRONMENT ISO 14001 - SAFETY ISO 45001

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