DISPOSABLE FORMWORK SYSTEM FOR VENTILATED FOUNDATIONS

modulo

the formwork for ventilated foundations

• VENTILATED CRAWL SPACE
• HIGH LOAD-BEARING CAPACITY
• LOGISTICS ADVANTAGES

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Humans have always felt the need to live in comfortable houses, experimenting, since the beginning, construction methods to separate the buildings from the ground: Neolithic pile dwellings answered this precise need. Ancient Romans built elevated floorings to improve air circulation under their houses, eliminating rising damp and at the same time heating the rooms of the upper floors. Today, ventilated foundations are still the best solution to eliminate Radon Gas, a carcinogenic and very harmful gas which is naturally present in the subsoil. Geoplast has improved these ancient methods in order to allow you to live in healthier and safer buildings.

ANCIENT METHODS FOR NEW NEEDS:
HISTORY TAUGHT US HOW TO BUILD WHILE PROTECTING OUR HEALTH

Not only we transform our ideas into innovative and successful products: we are committed also to the study and selection of the most suitable materials in order to guarantee high quality and respect of the environment.

Polypropylene (PP) is a recyclable material that can be obtained from plastic waste regeneration.

Solid and strong, very resistant to both breaking loads and abrasions: regenerated polypropylene is a chemically inert material, neutral to the environment and non-pollutant when in contact with ground or water.

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the creation of ventilated foundations, i.e. a void crawl space built under the flooring to improve the health and safety of the house. MODULO is a non-reusable formwork that eliminates rising damp and RADON GAS, which can naturally be found in the soil. MODULO allows the construction of a reinforced concrete structure provided with a slab and a series of pillars placed at a fixed distance. Such a structure permits a uniform stress distribution all over the surface, thus producing an excellent load-bearing capacity, both static and dynamic. MODULO is made of regenereated and eco-friendly plastic materials, long-lasting and with a high mechanical resistance.
ISSUES CAUSED BY RADON GAS

WHAT IS IT?

RADON is an odourless and colourless radioactive gas that can be found in variable quantities in the Earth’s crust. The main emission source of this gas in the environment is the soil. Radon tends to accumulate in closed rooms in the buildings, especially in the ground floor. In these areas, RADON can reach high concentration levels, thus being very harmful for human health. This problem can be prevented from the planning stage.

The soil is a heterogeneous mixture of solid elements, air and water. The last one is the most subject to fluctuation, due to meteoric and groundwater contribution, evaporation and deep percolation. Water can cause serious issues when in contact with a traditional foundation: infiltrations, cold, humid and unhealthy environments, condensation, fungi and mold, as well as the possibility of deterioration of the timber elements of the structure. The direct contact with the ground causes rising damp issues to people and buildings. Rising damp is the most common type of humidity and can be found both in old and new buildings.
RISKS FOR YOUR HEALTH

W.H.O.
World Health Organization

RADON is the second cause of lung cancer after cigarette smoking. The World Health Organization supports this statement and classifies RADON GAS as one of the most carcinogenic and harmful substances for humans.

DAMP

What are the consequences?

- STATIC DAMAGES: the salts that can be found in the building material and in the soil melt down in the water. They rise up to the upper layer of the wall and increase their volume up to 12 times. The plaster will start to come off and the entire structure will deteriorate.

- AESTHETICAL DAMAGES: damp spots or marks, mould, paint that splits apart, deterioration of the structures and of the wooden furniture.

- HEALTH DAMAGES: the mould feeds on rising damp and releases harmful spores, moreover the places become unhealthy and cold facilitating diseases and physical discomfort.
THE VENTILATED CRAWL SPACE

WHY?
It is possible to defend ourselves against RADON GAS and against the problems related to rising damp and caused by the direct contact with the ground, only with a VENTILATED FOUNDATION. This innovative solution guarantees uniform and natural air circulation between the ground level and the ground floor. When properly ventilated, the crawl spaces, avoid the contact of the building with the ground and create an “EMPTY SPACE” with many benefits to the rooms health. GEOPLAST suggests a specific system for the creation of a ventilated crawl space: MODULO SYSTEM.

The history
Even the ancient Romans understood that the direct contact with the ground was not healthy: in fact, they built crawl spaces in order to eliminate rising damp from the building while heating their houses. The concept of VENTILATED FOUNDATION, synonymous with healthy houses, developed in this way.

ADVANTAGES
- RADON GAS MITIGATION
- RISING DAMP ELIMINATION
- BARRIER GROUND/FLOORING
- NO MOULD

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The chimney effect is a natural phenomenon generated within ventilated areas connected with the outside and it is produced by pressure differences. These differences are caused by the air density and the fluids temperature. It is possible to take advantage of this effect to improve the ventilation of a crawl space, thus creating the ideal air circulation for the elimination of rising damp and the dispersion of Radon Gas in the atmosphere.

HOW IT IS CREATED?

In order to improve the ventilation of the foundation created with MODULO, it would be useful to take advantage of the CHIMNEY EFFECT. For a proper ventilation, the system should be oriented from North to South or where not possible, from East to West. The greater the difference in height, the greater the air draught. The inlet pipes must be placed with:
- INLET: colder side (NORTH or EAST) and close to the ground level (~50 cm)
- OUTLET: warmer side (SOUTH or WEST) and in an higher position (usually at the height of the interfloor, if possible).

The air flow can be obtained creating holes of 80/120 mm diameter over the perimetral beams, every 3,50/4,00 m, provided with the PVC pipe connection and external stainless steel grids with anti-intrusion net. The pipe with the lower inlet must reach half of the formwork in order to guarantee an efficient air channeling and to generate a chimney effect.

To guarantee a uniform air circulation, all the areas must be connected together even when interrupted by foundation beam or herds. GEOBLOCK extensions need to be perforated in order to insert the pipe into the element to connect the crawl space with the outside. The connection must be made with worksite PVC pipes.

The chimney effect

The chimney effect is a natural phenomenon generated within ventilated areas connected with the outside and it is produced by pressure differences. These differences are caused by the air density and the fluids temperature. It
LIGHTENING OF THE SLABS

MODULO is also a lightening system that can offer many benefits. First, it is particularly useful in multi-storey buildings as the total structure becomes lighter with MODULO system. This lightness reduces the thickness of the slab, as well as the total load of the structure burdening on pillars and foundations. Second, there are savings both in terms of time, labour and material costs, because the amount of concrete and steel used is highly reduced. Finally, thanks to the creation of a void space in multi-storey buildings, MODULO ensures noise reduction, heat insulation and an higher living comfort.
With MODULO it is possible to raise the level of the floor and also create a structural void space that allows the passage of electrical, heating, ventilation, air conditioning and plumbing systems. This space allows an easy and economic functioning of the building. Cables and pipes can be laid before or after the construction and the maintenance is not invasive. Moreover, the implementation can be done both in new and renovated buildings. The surface is continuous unlike modular raised floors and has a very high load bearing capacity.
FILLING OF SLABS AND FOUNDATIONS

Thanks to its logistical advantages and lightness, MODULO is the best filling system. In comparison with traditional filling materials (such as: sands, gravel, etc...), MODULO is lightest since the extra load of the filling is only the concrete that comes on top of the system. Moreover, when used on the roof of a building, it lightens the entire structure, favouring the ventilation.

ADVANTAGES

- QUICK INSTALLATION
- ECONOMICAL ADVANTAGES
- TIME SAVINGS
- MATERIAL SAVINGS
ACOUSTIC INSULATION MINIMODULO

The law disposal, n° 447 dated 26/10/95, on noise pollution establishes the basic principles for the safeguard of the outdoor and indoor settings. As for the building sector, a Prime Minister’s Decree, dated 5/12/97, on the “passive acoustic requisites for the buildings”, was published. The decree defines the reverberation time, the apparent soundproofing power of the partition walls, the standardized soundproofing of the facade and the standard level of slabs noise impact.

MODULO H6 APPLICATION EXAMPLE

REDUCTION OF THE LEVEL OF NOISE IMPACT

Thanks to Modulo H6, Geoplast manages to reduce the slab noise impact up to 10 dB compared to what would happen in the same building without Modulo.

ADVANTAGES

- ACOUSTIC INSULATION
- SOUNDBOOFING POWER
- REDUCTION OF THE NOISE IMPACT
- IMPROVED REVERBERATION

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Thanks to its high versatility MODULO can be used as an alternative to the traditional inert filling systems. In the offices where the spaces are divided in different levels, MODULO is the perfect solution. It fills the gap between different levels without weighing on the entire structure.
Green areas have always been an additional value in our cities. In small areas where there is not enough space to use, different levels solutions had to be taken into consideration, so the concept of green roof had to be introduced. Green roofs need walkways to cross the green areas as it happens in our gardens and MODULO large range of heights are the best solution.

ADVANTAGES

- Load weight reduction
- High load bearing capacity
- Quick to install
- Thermal insulation

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When compared with traditional systems, it guarantees a faster installation up to the 80% (in respect to the use of the traditional inert materials).

MODULO system allows savings compared to the use of traditional inert materials, especially in terms of transport and installation.

void space

The void space created under MODULO allows an easy installation of electrical as well as mechanical systems. The void space is also perfect for ventilating damp and RADON GAS away from the building.

fast

light

By far it is the lightest filling solution; the total weight of the cross section is approximately equal to the thickness of the upper slab.

stackable

unmatched logistical advantages when transporting and storing. At a height of 50 cm, conventional filling requires 50 trucks of filling in comparison to only 1 truck of MODULO.

high load bearing

Countless pillars, arches and domes create the highest load bearing structure.
A SUMMARY OF THE TECHNICAL DATA

MINI MODULO

HEIGHT from 13 to 70 cm
WEIGHT PCS. from 0,55 to 4,29 kg

GEOBLOCK MODULO

HEIGHT from 13 to 40 cm
WEIGHT PCS. from 0,37 to 0,98 kg

MULTI MODULO

ACCESSORIES FOR VENTILATED FOUNDATIONS

GEOBLOCK MODULO

GEOBLOCK MULTIMODULO

HEIGHT from 13 to 70 cm
WEIGHT PCS. from 0,55 to 4,29 kg

HEIGHT from 13 to 40 cm
WEIGHT PCS. from 0,37 to 0,98 kg

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GEOPLAST offers a planning service on the basis of a DWG analysis of the foundation, in order to obtain a graphic file with an accurate counting of the pieces and a detailed installation scheme.

The combination of MODULO and GEOBLOCK allows the creation of a monolithic slab without the risk of cracks or breakage. The extension is an adjustable product, adaptable to any worksite situation and available for every MODULO height.

WHAT ARE THE ADVANTAGES?

A
STRUCTURAL CONTINUITY
single pour of crawl space and foundation beams

B
SAFETY IN THE WORKSITE
It is possible to walk over the formwork, especially along the perimeter, as there is always a complete element

C
ELIMINATION OF THE DOUBLE FORMWORK
thanks to GEOBLOCK the beams does not need to be formed internally

D
COMPENSATION ADJUSTABILITY
the depth of GEOBLOCK extension can be modified

E
NO CUTTING OF THE FORMWORK
the distances can be compensated without cutting the formwork

The planning

GEOPLAST offers a planning service on the basis of a DWG analysis of the foundation, in order to obtain a graphic file with an accurate counting of the pieces and a detailed installation scheme.

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The possibility to pour at the same time the crawl space slab and the foundation beams avoids the necessity of installing, pouring and dismantling the formwork for the foundation beams: the construction operations will be reduced to a single pour, with various cost-effective advantages thanks to GEOBLOCK, which works as a side cap of the formwork. Moreover, the single pour produces a higher resistance for the fragile coupling point between the beam and the slab.

1. Lean concrete
2. MODULO formwork
3. GEOBLOCK
4. Wire Mesh
5. Concrete slab

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### Dimensions of Modulo H65/H70

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GEObLOCK MODULO*

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GEObLOCK MULTIMODULO*

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ACCESSORIES OF MULTIMODULO SYSTEM

fermagetto in plastic paperboard
Side closure element for MULTIMODULO heights from 13 to 40 cm

ACCESSORIES OF MODULO SYSTEM

fermagetto *modu*lo
This element prevents the intrusion of concrete in the crawl space. It is available for MODULO heights from 13 to 40 cm

fermagetto in plastic paperboard
Side closure element for MODULO heights from 45 to 70 cm
## LOAD TABLES

### MINIMODULO

<table>
<thead>
<tr>
<th>LOAD (Kg/m²)</th>
<th>THICKNESS of the slab (cm)</th>
<th>WIRE MESH (mm)</th>
<th>THICKNESS lean concrete (cm)</th>
<th>THICKNESS gravel (cm)</th>
<th>GROUND pressure (Kg/cm²)</th>
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To evaluate each case, please contact Geoplast Technical Department

### MODULO 50 x 50

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<th>LOAD (Kg/m²)</th>
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<th>WIRE MESH (mm)</th>
<th>THICKNESS lean concrete (cm)</th>
<th>THICKNESS gravel (cm)</th>
<th>GROUND pressure (Kg/cm²)</th>
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To evaluate each case, please contact Geoplast Technical Department

### MODULO 71 x 71

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<th>LOAD (Kg/m²)</th>
<th>THICKNESS of the slab (cm)</th>
<th>WIRE MESH (mm)</th>
<th>THICKNESS lean concrete (cm)</th>
<th>THICKNESS gravel (cm)</th>
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To evaluate each case, please contact Geoplast Technical Department

### MULTIMODULO

<table>
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<th>LOAD (Kg/m²)</th>
<th>THICKNESS of the slab (cm)</th>
<th>WIRE MESH (mm)</th>
<th>THICKNESS lean concrete (cm)</th>
<th>THICKNESS gravel (cm)</th>
<th>GROUND pressure (Kg/cm²)</th>
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</tbody>
</table>

To evaluate each case, please contact Geoplast Technical Department

www.geoplast.it
MODULO + GEOBLOCK
INSTALLATION

1. **PREPARATION**
   Creation of a laying surface with lean concrete and installation of the external formwork and the reinforcements of the perimetral beams.

2. **FACILITIES**
   Installation of the pipes to place them into the perimetral ventilation holes and then place of the possible channeling systems for the pipes.

3. **FORMWORK**
   Installation of MODULO formwork following the instructions, from right to left as marked in the formwork, without any cutting.

4. **GEOBLOCK**
   Installation of GEOBLOCK to get closer to the reinforcements of the foundation: in this way GEOBLOCK permits the shuttering of the beams.

5. **REINFORCEMENT**
   Installation of the load distribution mesh on MODULO formwork and connect it to the foundation beams reinforcement.

6. **SINGLE POUR**
   Pour of the beams and the foundation slabs. Follow the instruction in order to pour correctly.

---

**WARNING**
MODULO formwork system must be installed FROM RIGHT TO LEFT AND FROM TOP TO BOTTOM, keeping the molded arrows pointing towards and to the left.

It is essential to verify the correct anchoring of the feet!

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After having installed some MODULO elements, it is possible to walk on the formwork, being careful to walk only in proximity of the pillars and not directly over the dome. Once the distribution welded wire mesh is placed, the whole surface is walkable. In the case of pumped concrete, keep the pump outlet at a maximal distance of 20 cm from the formwork, in order to avoid an excessive pressure. The pour should be performed by first filling partially the feet and then the upper part of MODULO, not vice-versa. Pour only after the place of the welded mesh and after having verified the correct installation of the formwork.

**Stage 1**
Partially fill MODULO feet

**Stage 2**
Partially fill all kerbs and foundation beams

**Stage 3**
Complete the pour of the feet, kerbs and foundation beams

---

DURING SUNNY DAYS WITH TEMPERATURES OF ABOUT 30°C, IT IS RECOMMENDED TO POUR IN THE COOLEST HOURS OR TO SOAK THE FORMWORK
DESIGN & ASSISTANCE
From predimensioning to load tests

Our technical unit is at your complete disposal.

OUR STRENGTHS ARE:

- FEASIBILITY ANALYSIS
- PREDIMENSIONING OF THE STRUCTURES
- ASSISTANCE DURING THE EXECUTIVE DESIGN

ANALISI F.E.M.

The F.E.M. analysis (Finite Element Method) allows the study of structures built with MODULO system. The research shows that the system’s leg has a solid body behaviour: that means that the system is not subjected to bending nor torsional strains.

Study results

SOLID BEHAVIOUR
REDUCED SYSTEM DEFORMATION
DOES NOT NEED REINFORCEMENT FEET

Tension stress diagram

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The crawl space for healthy houses

When applied to residential buildings, MODULO system protects the house against RADON GAS issues and allows, at the same time, the creation of void spaces in the foundations. When properly ventilated, these spaces facilitate the elimination of rising damp and RADON GAS that accumulate naturally under the building. The crawl space can be used for the passage of facilities.

Natural ventilation
Radon Gas dispersion
Rising damp elimination

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INDUSTRIAL BUILDING

Commercial and industrial buildings must be able to bear heavy loads. Thanks to their particular conformation, MODULO and MULTIMODULO create a solid ribbed foundation slab that guarantees an high load-bearing capacity, both static and dynamic. Moreover, the ventilated crawl space allows the creation of technical void spaces useful for the passage of facilities.

High load-bearing solutions

High load-bearing capacity
Fast installation
Technical void space
According to the latest health recommendations of the European Union (90/143/Euratom), schools and classrooms intended for children, in particular kindergartens and compulsory schools, must be healthy environments, free of harmful substances, above all RADON GAS. The creation of a ventilated crawl space with MODULO avoids dangerous gas accumulation in the school environment, protecting the students against the serious diseases caused by the exposition to RADON.
In warehouses and fridge cells the cold reaches the ground, lowering its temperature to below 0°C. This produces the freezing of the soil, thus increasing the water volume and causing cracks and deformations of the floor. The most cost-effective and safe solution to this problem is the building of a ventilated foundation between the ground and the building, in order to eliminate moisture infiltrations completely.

Fresh products, stored in safe environments

No frost heaving
High load-bearing capacity
Technical void space

www.geoplast.it
The innovative ventilated crawl space

**MINIMODULO** system is very useful in renovation interventions, as it allows the creation of ventilated floors with mini technical void spaces suitable for hydraulic pipes and electrical installations. The products’s heights range permits to intervene also with reduced thickness, thus avoiding loss of useful height. Moreover, in difficult to access areas, like historical centres, it simplifies logistics and transport as it is space-saving and easy to handle.

**Reduced thickness**
**Moisture elimination**
**Downstream intervention**

![Diagram](image)
Recently the construction world has increasingly focused on the planning of high energy-efficient buildings with high environmental comfort: this is possible also through the ventilation of roofs and walls. MINIMODULO is ideal for the creation of ventilated surfaces designed to reduce heat transmission and thermal shock. This system cools down the roof and walls during summer and warms them during winter. The form of the element and the short-distanced feet allow the creation of a ventilation chamber in both directions.

**Thermal comfort with ventilated roofs**

**Condensation effect elimination**

**Ventilation in both directions**

**Reduced weight of the elements**

*www.geoplast.it*
MODULO is particularly suitable for the creation of pre-fabricated "low cost houses". This is a particularly easy and fast system that improves life quality by separating the floor from the ground thanks to innovative construction methods. MODULO can be a winning solution also with last generation timber lodges: their only weakness is the necessity to create a ventilated foundation in order to thermally insulate the house. The ventilation created with MODULO eliminates rising damp protecting and sealing the timber frame.

High productivity
low-cost houses

Costs reduction
Healthy and safe house
Fast construction
Lightening systems for upper floors

The creation of a void space under the floor can be essential in the case of inter-floor slabs, as lower weights allow an improvement of the structure behaviour. The PP formwork weights less than the traditionally used inert filling materials, and permits a faster installation. The result is the lightening of the entire structure (this is very important in the case of upper-floors), avoiding the use of heavy filling materials which can be difficult to handle in the worksite.

Fast installation
Lightweight slab
Easy to handle on-site
Not only MODULO offers health advantages thanks to the ventilation of the foundation, but also it easily solves every problem related to the installation of facilities. In fact, the void space under the floor can be used for the passage of pipes or other installations that otherwise should be installed externally, thus increasing the flooring set thickness (this is not always possible in the project). It should be enough to place the pipes before the installation of MODULO, laying them compatibly with the formwork encumbrance.
MODULO allows the creation of rainwater storage and lamination tanks with a reduced height and a large surface. This is the ideal solution when the groundwater is close to the ground-level or during urban requalification interventions that could modify the hydraulic system of a certain area. The wide range of heights and the system resistance allow the creation of storage ponds adaptable to any situation.

Creation of storage tanks with reduced height

Reduced digging depth
Good storage capacity
High load-bearing capacity

www.geoplast.it
MODULO allows the creation of a perforated flooring, with a uniform distribution of the holes all over the surface. This facilitates a uniform diffusion of the air within the waste, in order to optimize the process and obtain an high quality final product. MODULO structure has an high resistance to loads, allowing the transit of the machinery for the load and unload of the material or for the waste mechanic treatment.

**Uniform air diffusion**

**Quick and easy installation**

**High resistance to loads**

Optimal treatment of organic waste