AZbox Bleu

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Commission in charge of issuing Technical Appraisals and  
Technical Application Documents  
(by-law of 21 March 2012)
On 5 April 2018, Specialised Group no.17 examined the request relating to the AZbox Bleu system submitted by the NIDAPLAST organisation. This Group issued the following Technical Appraisal concerning these components. This document, to which the Technical File drawn up by the applicant is appended, transcribes the Appraisal formulated by Specialised Group No.17 on the product and the provisions for installation proposed for its use in the target area of use and under the conditions of European France and its overseas départements, regions and authorities (départements, régions et collectivités d’Outre-mer - DROM-COM).

1. Brief definition

1.1 Brief description

The AZbox Bleu system for storage and infiltration of rainwater is made from polypropylene modules with a stack structure, and of various elements assembled on site.

The AZbox Bleu module comprises two half-modules, each made up of a plate pre-mounted on four corner supports. The space between the corner supports allows operating equipment to pass through and a water diffusion drain to be installed in the structure.

The AZbox Bleu modules may be placed side-by-side or stacked in order to form a reservoir for the purpose of receiving rainwater.

The principal characteristics of the AZbox Bleu modules are as follows:
- Colours:
  - plates: black,
  - corner supports: blue,
  - connectors and covers: yellow,
- Length: 1200 mm,
- Width: 600 mm,
- Height: 660 mm (after insertion).

1.2 Identification

In accordance with the reference system for QB marking each module element bears the following statements:
- NIDAPLAST,
- The commercial designation AZbox Bleu,
- The batch identification,
- The material (PP),
- The date of manufacture (year, month),
- The logo followed by the reference shown on the certificate.

2. APPRAISAL

2.1 Area of use

The AZbox Bleu modules are designed to make underground storage structures, under the conditions defined in section 1 and 7 of the Technical File, so as to enable:
- Rainwater to be retained when the structure is covered with a watertight geo-membrane,
- Or infiltration into the supporting ground when the structure is not designed to be water-tight.

It should be remembered that:
- The modules must never be located in zones liable to flooding,
- There must be an outlet: overflow and connection to a rainwater evacuation system.

2.2 Assessment of the system

2.21 Meets current laws and regulations and other fitness-for-use qualities

2.211 Health and environmental data

The AZBox Bleu products have no Environmental Statement (ES), and therefore no particular environmental performance may be claimed for them. The Environmental Statement documents do not fall within the scope of an appraisal of the system’s fitness for use.

2.212 Health aspects

This appraisal is formulated with regard to the holder’s written commitment to apply the regulations and particularly all regulatory obligations relating to hazardous substances, for the manufacture of the product, its incorporation into structures in the accepted area of use and its use.

Checking the information and declarations issued in application of regulations currently in force is outside of the scope of this appraisal. The holder of this appraisal remains fully liable for this information and these declarations.

2.2.23 Other fitness for use qualities

AZbox Bleu Ultra Light Cellular Structures and their installation comply with the recommendations of the Technical Guide “Ultra Light Cellular Structures (ULCS) for rainwater management (IFSTTAR-2011)”. The tests or studies undertaken by the applicant or at CSTB, together with the references supplied, show that those products perform satisfactorily in the area of use envisaged in 2.1.

Compliance with the design and installation conditions defined in the Technical File is an essential condition for correct operation of the system. The usable volume of the structures used limits the volumes of the excavations required. The module design can be adapted to topographical constraints on the structure. The structures created using AZbox Bleu modules must allow several functions to be carried out, which need to be examined:

Mechanical strength

A knowledge of and application of the geo-technical and hydrological characteristics of the soil is essential for the design and fabrication of the structure.

Compliance with the arrangements that are recommended by the project manager at the pre-study stage and submitted to the manufacturer, depending on the specific circumstances of the site, is essential in order to ensure the stability of the structure and to ensure its compatibility with any road-building applications.

It should be remembered that the long-term maximum allowable deformation of the structure is to be set by the Project manager. This requirement may limit the number of layers that are admissible, irrespective of other considerations to be taken into account. The long-term deformation value to be taken into consideration is 2 % of the total height of the modules.

Installation when there is a water table present must be subject to specific checks, as defined in the Technical Guide "Ultra Light Cellular Structures (ULCS) for rainwater management (2011)". Particular care should be paid to the means used to ensure the load-bearing capacity of the subjacent soil.

In addition, the means used by the NIDAPLAST organisation to ensure consistent mechanical performance of the modules, together with the experience gained with the product, allow the structure to be designed based on a safety coefficient YM of 1.85.

Hydraulic

The arrangements for calculating the infiltration flow-rates into the soil, the design dimensions of the structures and the general construction arrangements are defined in the Technical Guide "Ultra Light Cellular Structures (ULCS) for rainwater management (2011)" and in "Fascicule 70 Titre II".

Long-term reliability of hydraulic performance is intimately linked with the compliance with maintenance conditions.

2.22 Durability – Maintenance

2.221 Material

Given the nature of the material of construction, the durability of the components is not a particular problem.

2.222 Conditions for access

The conditions for access as defined in the Technical File are satisfactory. Access must be gained using inspection chambers or hatches located upstream and downstream of the structure, or using infiltration wells in the roof of the tank, which allow all stages of the module to be accessed.

2.223 Long-term reliability of the functions

The Ultra Light Cellular Structure cannot be cleaned out fully. Only the diffusion channels or drains can be cleaned more or less completely.
The installation of an upstream treatment device minimises the frequency of maintenance operations and ensures long-term functional reliability of the storage structure.

Consideration must be given to the characteristics of the rainwater (presence of macro-waste, dead leaves etc.) in order to define the access conditions, the percolation channels and the nature of the prior treatment.

The functions that are expected of the structure are conditional upon compliance with the maintenance requirements.

The inspection hatches or chambers and channels must be inspected, and if necessary, cleared out after heavy rain or accidents, and at a frequency which is appropriate for the site conditions. Maintenance operations are to be appropriate depending on the result of these inspections.

In the case of infiltration structures, compliance with the project design study approach as defined in section 3 of the ULCS guide (nature of the effluents, soil characteristics etc.) and of maintenance conditions are essential to ensure that the infiltration capacity is maintained over time.

On condition that the design rules and maintenance arrangements are complied with, the storage volume of the structure can be considered to be maintained over time.

2.23 Manufacturing and inspection

The manufacture of the various component parts of the AZbox Bleu modules is performed using injection moulding.

The books of specifications relating to the material have been submitted to CSTB.

The manufacture of components making up the AZbox Bleu modules is subject to internal inspections incorporated in a quality system based on standard NF EN ISO 9001 (2008).

The internal and external inspections as described in the Technical File ensure that acceptably consistent quality is achieved.

This appraisal is formulated taking into consideration the manufacturing checks and inspection methods described in the Technical File drawn up by the Applicant (DTED).

2.24 Installation

The products must be installed in accordance with the indications shown in chapter 7 of the Technical File.

The installation conditions must be rigorously monitored.

Particular attention must be paid to the flatness of the support bed, to the choice of backfill materials and compacting conditions, in particular in the case of an infiltration structure.

The light weight of the modules facilitates their installation.

2.3 Technical Specifications

2.31 Product characteristics

The characteristics of the AZbox Bleu modules must be in compliance with those indicated in the Technical File.

2.32 Design - Dimensioning

The elements that must be collated in the context of the prior study are defined in the Technical Guide "Ultra Light Cellular Structures (ULCS) for rainwater management (2011)" and in "Fascicule 70 Titre II".

These in particular include the following elements:

- associated with the physical environment: terrain topography, height of water table, permeability and geo-technical characteristics of the soil.
- associated with urbanisation: re-use of space, presence of buildings, water quality and use, traffic.
- assessment of water variables: catchment area, active surface, volumes and flows based on Technical Memento (Technical Instruction 77/284).

2.33 Manufacturing and inspection

Inspection as described in the Technical File must be implemented by the manufacturer.

2.34 Installation

Compliance with the installation conditions stated in chapter 7 of the Technical File is an essential condition for ensuring correct operation and long working life of tanks formed from AZbox Bleu modules.

The same is true for additional requirements specified by the Project manager which are a consequence of the specific conditions of the site of the retention and rainwater infiltration tank.

Conclusions

Overall assessment

The use of the AZbox Bleu modules in the accepted area of use is favourably assessed.

Validity

Until 31 May 2021.

For Specialised Group No. 17

The Chairman

3. Additional comments from the Specialised Group

Specialised Group no.17 draws the designer’s attention to:

- the importance of protecting these structures to prevent the introduction of materials which might settle out,
- the constraints associated with clearing-out operations. In particular, the pressurised water cleaning systems selected must be verified to ensure that they are compatible with the product characteristics.

Rapporteur of Specialised Group no. 17
A. Description

1. Principle

The AZbox Bleu retention and infiltration system was designed for the construction of underground storage structures (tanks, valleys or infiltration pits) to ensure optimised management of rainwater run-off and is intended for applications in the field of public works and civil engineering, as well as for individual rainwater treatment.

These products fall into the category of structures that are built as defined in the guide "Ultra Light Cellular Structures (ULCS) for rainwater management" published in December 2011 by IFSTTAR.

They have a stackable structure and the various elements can be handled manually.

They can be adapted to meet different site constraints in terms of mechanical strength and water flow depending on the type of operation of the tank.

Structures made from AZbox Bleu modules and the various accessories allow the following functions to be carried out:

**Service functions:**

The service functions performed by structures made from AZbox Bleu modules are storage and/or infiltration.

Effluents are retained when the structure is covered with a water-tight geo-membrane.

When the structure is not designed to be water-tight, infiltration into the supporting soil can occur.

**Technical functions:**

The technical functions carried out by structures made from AZbox Bleu modules are as follows:

**Collection and release (See figure 7):**

Both these functions are carried out using accessory components, comprising inspection hatches, interface components and diffusion channels formed in the space between the corner supports.

The installation of drains between the corner supports allows rainwater to be distributed inside the structure and channels suspended solids, thus facilitating the maintenance of the structure.

In the case of a water-tight structure, the evacuation flow-rate is a function of the fill level of the tank and of the internal diameter of the connection to the evacuation network, or is regulated by means of a suitable device.

**Structural:**

The structural character of the blocks allows soil to be used at the surface.

**Access:**

AZbox Bleu modules are designed to allow maintenance and to be cleared out with pressurised water at all levels, on condition that access pits at each level are installed.

Access is gained by means of inspection hatches or chambers at the periphery, or by access wells in the upper parts of the tank. (See figure 7).

Furthermore, if diffusion drains are installed, these can be inspected and cleared out using pressurised water between the upstream and downstream inspection hatches to which the drains are collected.

**Ventilation:**

The structure must allow air pressure to equilibrate during filling and emptied.

1.1 The AZbox Bleu modules

A module AZbox Bleu is made up of 2 half-modules assembled together manually on site. Each half-module is made up of 4 corner supports fixed on an open plate.

Two modules are joined together using a fastening system and are assembled on site.

1.2 Module sub-components

1.21 Corner supports (See figure 1)

The corner supports are designed to be easily and permanently assembled together. The assembly of corner support/plates is facilitated by fool-proofing devices which ensure that the completed assembly conforms to requirements. Assembly marks are engraved on the components.

The corner supports have holes in their upper surface to allow filling and emptying to take place. They are blue in colour.

1.22 Open plates (See figure 2)

The open plates form the base of the structure and are the interface components between each stage of the module. They are supplied pre-fitted with 4 corner supports, thus forming a half-module.

They allow ventilation and inspection wells to be formed by connecting a corrugated tube DN/ID 300 CR8 (type R2 in terms of NF P 16-351, without holes) using an adaptor sleeve which can be obtained from Ni-daplax. Cutting on site is facilitated by a template.

1.23 Closed plates (See figure 3)

Closed plates are installed at the periphery of the structure. They may be cut in two.

In particular they are used for drain outlets inside the structure, cylindrical road drain DN/ID 300 (type R2 in terms of standard NF P 16-351) or DN/OD 355 (type R1) maximum. Cutting on site is facilitated by a template.

1.24 Covers (See figure 5)

Covers are used to close off the open plates of modules in the upper layer of the tank.

1.25 Connectors (See figure 4)

Connectors are used to join two modules in a horizontal plane.

1.26 Diffusion drain

The diffusion drain allows rainwater to be introduced and to diffuse inside the structure.

This drain may be installed between the corner supports of the AZbox Bleu modules. The space that is available between the corner supports means that a road drain can be used whose characteristics are as follows:

- complies with standard NF P16-351,
- maximum internal diameter: 355 mm,
- rigidity class CR8,
- minimum capture surface area 50 cm²/m.

The NIDAPLAST organisation can supply the NIDADRRAIN DN/ID 300 drain (type R2 in terms of standard NF P 16-351) with a capture surface area greater than 240 cm²/m.
The upper 2/3 of the drain are open, to allow hydraulic continuity at low flows between the upstream and downstream of rainwater storage structures. The drain is connected to the network through an inspection hatch with an adaptor sleeve if necessary.

1.27 Upper stages
The upper stages are made by successively adding 4 corner supports onto the open plate of the top layer, then fitting a half-module (open plate pre-fitted with 4 corner supports).

<table>
<thead>
<tr>
<th>Height (mm)</th>
<th>1 module</th>
<th>2 modules</th>
<th>3 modules</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>660</td>
<td>1270</td>
<td>1880</td>
</tr>
</tbody>
</table>

1 level 2 levels 3 levels

2. Method of manufacture and materials

2.1 Manufacturing method
The parts are manufactured using injection moulding.

2.2 Materials
The material used for all the injection moulded parts is a controlled blend of virgin and/or recycled polypropylene and additives, the purchase specification and compositions for which have been submitted to CSTB.

2.21 Corner supports
The characteristics of the material mixtures used for manufacturing the corner supports are shown below:

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Specifications</th>
<th>Test parameters</th>
<th>Test methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>≥1100 kg/m³</td>
<td>T=23 ±2°C</td>
<td>NF EN ISO 1183</td>
</tr>
<tr>
<td>Melt flow index</td>
<td>From 3 to 28 g/10min.</td>
<td>T=230°C / 2,16 kg</td>
<td>NF EN ISO 1133</td>
</tr>
<tr>
<td>Tensile strength at flow limit</td>
<td>≥ 24 MPa</td>
<td>Speed 50 mm/mm</td>
<td>NF EN ISO 527</td>
</tr>
<tr>
<td>Tensile or flexing modulus</td>
<td>≥ 2500 MPa</td>
<td>Speed 2 mm/mm</td>
<td>NF EN ISO 527</td>
</tr>
<tr>
<td>Thermal stability (OIT*)</td>
<td>≥ 8 min.</td>
<td>200°C</td>
<td>NF EN 728</td>
</tr>
</tbody>
</table>

* Checks on finished products

2.22 Plates and accessories
The characteristics of the material recipes used for manufacturing the plates and accessories are shown below:

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Specifications</th>
<th>Test parameters</th>
<th>Test methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>≥890 kg/m³</td>
<td>T=23 ±2°C</td>
<td>NF EN ISO 1183</td>
</tr>
<tr>
<td>Melt flow index</td>
<td>From 5 to 20 g/10min.</td>
<td>T=230°C / 2,16 kg</td>
<td>NF EN ISO 1133</td>
</tr>
<tr>
<td>Tensile strength at flow limit</td>
<td>≥ 18 MPa</td>
<td>Speed 50 mm/mm</td>
<td>NF EN ISO 527</td>
</tr>
<tr>
<td>Tensile or flexing modulus</td>
<td>≥ 800 MPa</td>
<td>Speed 2 mm/mm</td>
<td>NF EN ISO 527</td>
</tr>
<tr>
<td>Thermal stability (OIT*)</td>
<td>≥ 8 min.</td>
<td>200°C</td>
<td>NF EN 728</td>
</tr>
</tbody>
</table>

* Checks on finished products

3. Product description

3.1 Appearance, finish
The corner supports are blue in colour. The plates are grey coloured. The covers and connectors are yellow in colour. AZbox Bleu products are free of any visual defects which could adversely affect their function.

3.2 Dimensions
The dimensions of the constituent components of an AZbox Bleu module are as follows:

<table>
<thead>
<tr>
<th>Corner Supports</th>
<th>Open plate</th>
<th>Closed plates</th>
<th>Cover</th>
<th>Connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length (mm)</td>
<td>422</td>
<td>1200</td>
<td>1192</td>
<td>417</td>
</tr>
<tr>
<td>Tolerances (mm)</td>
<td>+/−3</td>
<td>+2/−10</td>
<td>+2/−10</td>
<td>+/−3</td>
</tr>
<tr>
<td>Width (mm)</td>
<td>228</td>
<td>600</td>
<td>558</td>
<td>224</td>
</tr>
<tr>
<td>Tolerances (mm)</td>
<td>+/−3</td>
<td>+2/−10</td>
<td>+2/−10</td>
<td>+/−3</td>
</tr>
<tr>
<td>Height (mm)</td>
<td>343</td>
<td>49.5</td>
<td>49.5</td>
<td>29.5</td>
</tr>
<tr>
<td>Tolerances (mm)</td>
<td>+/−3</td>
<td>+/−0.5</td>
<td>+/−0.5</td>
<td>+/−0.5</td>
</tr>
</tbody>
</table>

These functional dimensions together allow the structure to be assembled correctly and are subjected to specific dimensional checks. The minimum wall thickness at the corner supports is 3.8 mm.

3.3 Mass
The masses of the constituent components of an AZbox Bleu module are as follows:

<table>
<thead>
<tr>
<th>Corner Supports</th>
<th>Open plate</th>
<th>Closed plate</th>
<th>Cover</th>
<th>Connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass (g)</td>
<td>1850</td>
<td>6500</td>
<td>5350</td>
<td>360</td>
</tr>
<tr>
<td>Tolerances</td>
<td>+/−3%</td>
<td>+/−3%</td>
<td>+/−3%</td>
<td>+/-6%</td>
</tr>
</tbody>
</table>

3.4 Usable volume
For the first layer of a structure, the gross volume of a module is 475 litres and the usable storage volume is 451 litres. For all the upper layers the gross volume is 439 litres and the usable storage volume is 422 litres.

The storage volumes are obtained from the dimensions, weights and density of the material.

3.5 Mechanical characteristics

3.51 Short-term characteristics

3.511 Unconfined compressive strength of a base module
The unconfined compressive strength is determined using elementary modules comprising 2 corner supports and 2 open plates.

The unconfined compressive strengths measured in accordance with standard XP P16-374 in the X, Y and Z direction are as follows:

<table>
<thead>
<tr>
<th>Direction in which force is applied</th>
<th>Specifications</th>
<th>Test parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>X: Side face 600 x 660 mm</td>
<td>Minimum breaking load</td>
<td>Test speed 5 mm/min</td>
</tr>
<tr>
<td>Y: Side face 1200 x 660 mm</td>
<td>140 kPa</td>
<td>Temperature 23 ± 2°C</td>
</tr>
<tr>
<td>Z: Upper face 1200 x 600 mm</td>
<td>380 kPa</td>
<td>Age of blocks &gt; 7 days</td>
</tr>
</tbody>
</table>

Remark: The unconstrained compressive strength reflects the consistency of manufacture of the products, and serves to verify the suitability for use on site. It is not sufficient, however, for establishing mechanical design dimensions of the finished structure. For factory-based inspection a quarter of modules are checked.

3.512 Compressive strength of stacked modules
Type tests have been carried out for two stacked module levels. The vertical compression strength is equal to or greater than 380 kPa for the modules AZbox Bleu.

3.513 Compressive strength of modules with slope defect
Type testing show that a sub-grade slope of 1 % has no impact.

3.52 Long-term characteristics

3.521 Allowable long-term vertical load
The long-term behaviour of AZbox Bleu modules has been determined on the basis of tests based on deformation and failure criteria measurements. The tests are based on a series of long-term unconstrained compressions, carried out over a minimum period of 7500 hours.
These tests gave a regression line from which the maximum admissible vertical pressure which would lead to failure of the modules after 50 years’ service could be determined. The maximum extrapolated vertical pressure is 130 kPa for AZbox Blue modules.

3.52 Allowable long-term horizontal load
The long-term behaviour of AZbox Bleu modules has been determined on the basis of tests based on deformation and failure criteria measurements. The tests are based on a series of long-term unconstrained compressions, carried out over a minimum period of 3000 hours. These tests gave a regression line from which the maximum admissible horizontal pressure which would lead to failure of the modules after 50 years’ service could be determined. The maximum extrapolated horizontal pressure is 49 kPa for the modules AZbox Bleu.

4. Marking
The marking of AZbox Bleu module complies with requirements associated with the Technical Appraisal and with the QB mark reference system.

5. Packaging, handling, storage
5.1 Packaging
The various AZbox Bleu components are delivered stacked on a single-use pallet. The connectors and covers are delivered in cartons.

5.2 Handling
Usual precautions must be observed, such as the use of a forklift truck, in order to avoid damaging components. Sudden handling movements and components falling to the ground when they are being unloaded should be avoided. Unpacking operations should be carried just before the products are used as the work on site progresses.

5.3 Storage
Each pallet must be stored on a flat surface which is free of any objects which might damage the products. The maximum storage period outside is one year.

6. Design studies and design dimensions
The information provided must allow the conditions for installation of the structure to be characterised. It should be emphasised that the information shown in said technical design studies are elements to assist with the design. They allow the project manager to establish the design dimensions and to carry out the validations that they are responsible for.

6.1 Prior study
The project manager submits the results of the prior study, in particular the geological and hydrological environment in which the structure is installed and in particular:

- the geo-technical conditions (feasibility and potential geo-technical hazards, soil stability, shallow hard rock horizons, density, earth pressure coefficient), hydro-geological conditions (subjacent water table etc.),
- hydraulic conditions (profile, design dimensions of upstream/downstream systems, feed and drainage devices etc.).

6.2 Volumes
6.21 Excavation volumes
The excavation volume is determined in accordance with the requirements of the Technical Guide “Ultra Light Cellular Structures (ULCS) for rainwater management” (December 2011) (section 5.2.).

6.22 Usable volume of the structure
The hydraulic design calculations for the storage device are to be performed by the project manager or main contractor, as relevant. The usable volume is determined by the project manager in accordance with the requirements of the Technical Guide “Ultra Light Cellular Structures (ULCS) for rainwater management”.

The usable volume of the structure must take into account:

- The usable volume and the number of modules installed,
- The effluent water flow,
- Any slope of the sub-grade in the case of a water-tight structure. The sub-grade slope of the tank is generally 0.5% and must be less than 1%.
- The size of the pipework used for ventilation of the structure.

In the case of a retention structure, the net volume of the structure is reduced by the volume between the bottom of the structure and the water outlet. The height between the bottom of the tank and the water outlet is 50 mm.

In the case of an infiltration structure, the net volume is the same as the maximum theoretical volume.

6.3 Mechanical behaviour
The design dimensions are established in accordance with the Guide “Ultra Light Cellular Structures (ULCS) for rainwater management” (December 2011).

Depending on the product, and in the absence of any specific requirements pertaining to construction, the tank may be installed beneath pavements, roadways, verges or green spaces, within the following limits:

- the minimum depth of overlay in green spaces is at least 0.30 m,
- beneath pavements or verges with Hr ≥ 0.50 m,
- beneath moving loads, the design dimensions will depend on the envisaged traffic:
  - beneath light traffic roadways (PTEC < 3.5 t) with Hr ≥ 0.60 m,
  - beneath heavy traffic roadways (BC convoy type) with Hr ≥ 0.80 m.

A safety coefficient of 2.5 is to be applied to the long-term maximum allowable vertical pressure extrapolated to 50 years. This safety coefficient, used for establishing the design dimensions of the structures, corresponds to a y of 1.35 and a y of 1.85. The same is to be done for the admissible maximum horizontal pressure.

AZbox Blue retention structures can be installed if there is a water table present. In this case design dimensions should be established by taking this variable into account in validating the mechanical strength of the structure and its behaviour in terms of the Archimedes buoyancy effect.

6.4 Diffusion drain
In the case of a diffusion drain being installed, the number of drains necessary for the structure to operate correctly must be established by prior calculation of the design dimensions, so as to ensure that the diameter and the drain capture surface area envisaged allow the tank to fill and empty satisfactorily during use.

7. Installation
Installation operations must be carried out in accordance with the minimum requirements of the Technical Guide “Ultra Light Cellular Structures (ULCS) for rainwater management” (December 2011).

The installation of the AZbox Bleu product is the subject of general installation requirements.

7.1 Groundwork operations
Groundwork and excavation must be undertaken in accordance with the requirements of “Fascicule 70, titres I and II”.

The general excavation dimensions must be at least 50 cm wider on each side than the unit dimension of the tank, and must take the characteristics of the natural ground into account. The length must also take the number and diameter of hatches into consideration.

The dimensions of the excavation must allow safe access in accordance with the regulations and allow the following operations to be carried out:

- connection of the pipework to the tank,
- installation of accessories and hatches,
- placement of the geo-textiles and/or geo-membranes,
- installation of any drains,
- backfill and compacting with a suitable material.

In the case of an infiltration device, a minimum distance of 5 metres from the nearest building must be observed.

In all events the drawings and installation locations defined by the project manager must be complied with.

7.2 Support bed
The blocks are to be installed on a pre-compacted flat surface which has fully settled, with a slope of 0 to 0.5%.

Particular care must be taken with the flatness of the support bed in order to ensure that the structure is stable and to allow easy installation.

- In the specific case of infiltration, the support bed must be made with a drainage material which forms the sub grade.
- In the case of a sealed tank, since settling of the sub-grade occurs below the geo-membrane sealed device, every precaution must be taken to prevent it being damaged.
- The use of crushed material with a 5/15 particle size distribution or compacted sand is preferred.
7.3 Geo-membrane and/or geo-textile / water-tightness device

Installation characteristics and conditions for the geo-textile and for the water-tightness device are selected and implemented in accordance with the minimum requirements of the Technical Guide "Ultra Light Cellular Structures (ULCS) for rainwater management" (December 2011).

The characteristics must be appropriate for the tank configuration. In particular, in the case of heterogeneous supporting soils the use of a high-modulus geo-textile is recommended in order to ensure that the modules are held tightly together, thus ensuring monolithic operation of the ULCS structure.

7.31 Infiltration tank

In the infiltration case, a geo-textile which has sufficient filtration opening is preferred. The characteristic values of the various functions and the mechanical and hydraulic properties are to be appropriate for the site requirements.

7.32 Retention tank

A retention tank comprises an outlet where the discharge flow can be regulated. It may or may not be water-tight, depending on the project manager's requirements in terms of local constraints. These are in particular associated with protection of the water table.

7.33 Water-tight tank

In the case of water-tight tanks, they are made water-tight in accordance with best practices and in the case where water-tight membranes are used, in accordance with the general recommendations for ensuring water-tightness using geo-membranes of "Fascicule 10" of the "Comité Français des Géotextiles et Géomembranes "Recommandations générales pour la réalisation d'étanchéité par géomembranes".

7.4 Installation of modules

7.41 Preparation

Check that the modules are seated correctly by carefully adjusting the diffusion layer or support bed as indicated in section 7.2.

7.42 Creation of the first layer

Special care must be taken with the first layer of modules, as the quality of installation of the following layers will depend on this.

A first course of open plates, each pre-fitted with 4 corner supports, is placed directly on a compacted and levelled sub-grade.

Diffusion drains are arranged between the corner supports of the first stage, linking the upstream and downstream hatches of the tank, where appropriate.

A second course of plates pre-fitted with 4 corner supports is then fitted directly onto the first lower half-modules to complete the first layer.

7.5 Fabrication of upper modules

The upper stages are made by fixing four corner supports onto the open plate of the lower layer, then fixing one more half-module (open plate pre-fitted with 4 corner supports) onto the corner supports.

All the open plates are linked to each other by connectors.

The last open plate forming the top of the ULCS is closed off using covers designed for this purpose.

7.6 Ventilation / inspection wells

To prevent the structure becoming pressurised an air evacuation device must be made.

Ventilation of the structure is achieved using ventilation wells in the roof of the tank (See section 8).

In the case of ventilation in the roof of the tank, the ventilation and inspection wells are obtained by cutting out the upper part of the module, at the indication marks, using a jigsaw.

Position the DN/ID 300 type adaptor sleeve, a DN/ID 300 CR8 type corrugated drain (types K3 in terms of NF P 16-351). Fit a distribution slab (in the case of moving loads), the crown device and the appropriate cover. Inspection hatches or chambers

7.7 Inspection hatches or chambers

These are installed in accordance with the requirements of "Fascicule 70".

7.8 Backfill

Backfill operations must be carried out in accordance with the minimum requirements of the Technical Guide "Ultra Light Cellular Structures (ULCS) for rainwater management" (December 2011).

All materials of the roadworks guide classification "Guide des Terrassements Routiers" [SETRA, LCPC, 1992] may be used for backfill except materials of diameter greater than 60 mm and clay materials.

The recommendations of "Fascicule 70" and of standard NF P98-331 must be observed.

7.81 Side-fill

In the backfill and compacting stage, care must be exercised to prevent asymmetrical stresses on the structure. This is achieved by backfilling and then compacting in successive layers alternately on either side of the structure.

The re-use of excavation materials is to be encouraged, once large components have been screened out.

Take care not to damage the geo-textile and/or the geo-membrane water-tightness devices.

Depending on the type of backfill used:
- If compaction is necessary, carry this out using low-power tools in successive 30 cm layers.
- Other types of material, such as gravel (20/40 rounds for example), are put in place without compacting.

7.82 Covering

Driving over AZbox Bleu modules is prohibited before backfilling and compacting.

The use of a vibrating compactor of width less than 1.3 m of class PV4, or of a vibrating plate of class PQ4 (see NF P 98-736 Tables 7 and 9) is recommended for this operation.

Backfill over the tank progressively using a compacted layer of 30 cm minimum.

8. Access to the structure

Access can be gained to the structure by means of:
- inspection hatches or chambers at the periphery of the structure,
- inspection wells made in the roof of the structure (See Figure 8 and section 7.6) which allow access to each stage of the modules for maintenance of the structure.

9. Upkeep and maintenance

General conditions for maintenance and operation of the structures are carried out in accordance with the Technical Guide "Ultra Light Cellular Structures (ULCS) for rainwater management" (December 2011).

The space available between the AZbox Bleu corner supports allows access equivalent to a road drain of diameter 355 mm.

If necessary, clearing out with pressurised water is carried out using a cleaning head with a pressure of less than 120 bar and whose flow is between 120 and 300 l/min.

Most cleaning head types may be used, except for chain heads (which could damage the modules or the drain) and rotary heads (which could cause settled material to be returned into suspension).

The use of a specific treatment upstream can reduce the frequency of maintenance operations.

10. Method of commercialisation

AZbox Bleu modules and their accessories are marketed through a network of distributors.

11. Internal inspections

AZbox Bleu modules are manufactured in manufacturing facilities which use a Quality Assurance Plan.

11.1 Raw material checks

A certificate of conformity of type 3.1 in terms of standard NF EN 10204 is provided by the supplier(s) for each batch of material.

Approval of a new material is subject to a specification relating to the compliance of values with the table of materials (see section 2.2), compliance of all characteristics of the finished product, and of the short and long-term mechanical performance of the finished product.

11.2 Checks on the manufacturing process

Production parameters and inspections are subject of specific procedures.

11.3 Checks on finished products

The following checks are carried out.

Samples of each part are taken: corner supports, open plates, closed plates, connectors, covers.
### 12. Certification

#### 12.1 Quality system

#### 12.2 Certification

##### 12.2.1 Product
AZbox Bleu modules are QB mark certified. This shows that the consistency and results of internal checks for each manufacturing site are satisfactory.

Products which hold a valid certificate can be identified by the presence of the QB logo on the products.

The certified characteristics are as follows:
- dimensional characteristics (see 3.2),
- determination of the unconstrained compressive strength of a module (see 3.51).

As part of the certification process, CSTB audits production sites in accordance with the QB reference system for:
- Validation of the quality system,
- Sampling of a block and performance of the mark laboratory tests (dimensional, mechanical strength).

The results of this monitoring are examined by the certificate assessment committee.

### B. Experimental results

Sites have been used as reference sites and as a result reference sheets which show the techniques for tank operation have been submitted to CSTB.

The following tests relating to AZbox modules are the subject of CSTB CAPE AT 15-083 reports:
- dimensional characteristics,
- material characteristics,
- unconstrained compressive strength tests in directions X, Y, Z.
- unconstrained compressive strength tests on two layers in the Z direction.

The effect of a slope defect of 1% on the module is the subject of report no. CAPE 17-8592.

Lateral compressive strength was the subject of additional tests in MFPA: PB 5.2/15-248-1.

The long-term behaviour of the product in the lateral and vertical direction was the subject of internal laboratory reports NIDAPLAST RPE FLUAGE AZBOX NOIR/BLEU MAY 2016 CSTB V1 FR as well as additional tests carried out by the MFPA laboratory PB 5.2/17-264-1.

### C. References

#### C1. Health and Environmental Data

The AZbox Bleu products are not subject to an Environmental Statement (ES). Therefore, no particular environmental performance may be claimed.

The purpose of ES data is for calculation of environmental impacts of structures in which the products (or processes) in question are likely to be incorporated.

#### C2. Other references

A list of references has been submitted to CSTB.

(1) Not examined by the Specialised Group within this Technical Appraisal.
Tables and figures of the Technical File

Figure 1 – AZbox Bleu corner support

Figure 2 – open plate

Figure 3 – closed plate
Figure 4 – Connector

Figure 5 – Cover

Figure 6 – AZbox Bleu Assembly
Figure 7 – Representative cross-section of AZbox Bleu collection and retention tank
Figure 8 – Schematic diagram for the creation of access well in the top of the tank.