ISLAND CITY
CONSTRUCTION

Technical Explanations

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Island City Construction is a project of:

HEXA TEC UG
Industriestraße 6
16727 Velten

DURA-*Protect*™
MODULE-*Matrix*™
AAC-*Plus*™

Are protected brand names of:

HEXA TEC UG
Industriestraße 6
16727 Velten

Layout:
B.A. Tanja Wenzel

3D design and visualization:
Raoul Emons

Concept and content:
Certified PR-Specialist Michael Kostic, Dipl.-Ing. Michael Rutzen

Island City Construction
Industriestraße 6
16727 Velten

www.island-city-construction.com
info@icc-mail.de

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THE PRODUCT

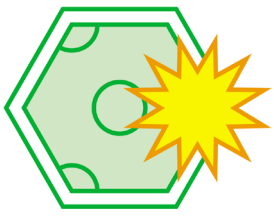
MODULE-*Matrix*™

The system invented by us is a completely new, modular concept for the construction of floating platforms of any size in almost any body of water. It consists of an almost arbitrarily large set of identical modules, which we call MODULE-*Matrix*™ in their entirety. Our MODULE-*Matrix*™ is not to compare in its physical behaviour to conventional hollow bodies, which are currently used on waters, such as ships or offshore oil drilling platforms. Platforms made of MODULE-*Matrix*™ often have a 5-fold increase in dead weight compared to them. Following the general rules of physics, here the rules of inertia, they interact fundamentally different with the surrounding water masses. Therefore, situations like those that occur on conventional ships do not occur on our platforms; hardly noticeable rolling and yawing, hardly perceptible swinging. The MODULE-*Matrix*™ can be mounted in almost any shape and can be extended, modified or dismantled even after decades. After dismantling, the individual modules can easily be reused for the construction of new MODULE-*Matrix*™ platforms.

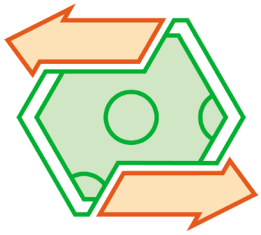
DURA-*Protect*™

Each individual module of AAC-*Plus*™ is coated with a special protective layer of DURA-*Protect*™ and handles the following tasks:

The modules are protected against the ingress of liquids (see „Water and diffusion barrier layer“ below).



The modules are given strong edges and surface protection, which makes them as impact, scratch and shock resistant as possible.



The tensile and bending strength of the modules is increased by the layer thickness.

AAC-*Plus*™

HOLLOW BODY

Floating structures are usually constructed from hollow bodies, such as ship hulls made of steel. If there are no supporting structures in these hollow bodies, enormous bending stresses occur under load (see Fig. 1). These hollow bodies must therefore be made pressure-resistant by suitable support structures in order to be able to carry heavy loads on the water (see Fig. 2).

AUTOCLAVED AERATED CONCRETE

However, this is not necessary for autoclaved aerated concrete, as the supporting structures are evenly distributed in the material in the form of pores (see Fig. 3). The special thing about autoclaved aerated concrete is that it can be produced with a density of approx. 0.25g/cm³ to 0.6g/cm³, depending on requirements. It is therefore lighter than water (density approx. 1g/cm³) and is the perfect floating body for the construction of large, load-bearing structures. Autoclaved Aerated concrete has a homogeneous structure and is almost inelastic. This regular autoclaved aerated concrete is very susceptible to tensile and bending loads. In addition, it has a very easily deformable surface structure.

AAC-*Plus*™

Of course we do not use regular raw autoclaved aerated concrete, like it comes from customary productions. The AAC-*Plus*™, exclusively manufactured by us, is a special design, made out of desert sand, whose tensile strength is significantly increased without metal reinforcement. The bending load capacity could also be greatly increased (see Fig. 4).

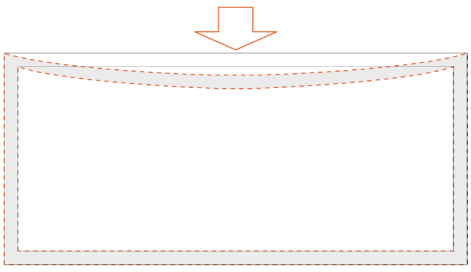


Fig. 1

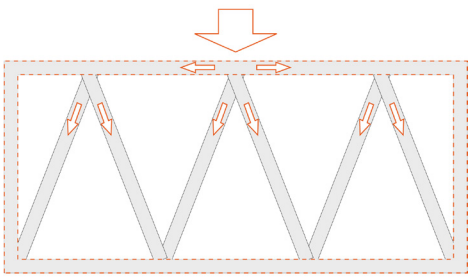


Fig. 2

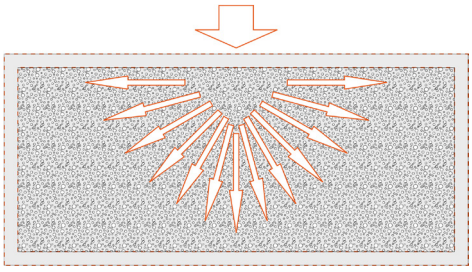


Fig. 3

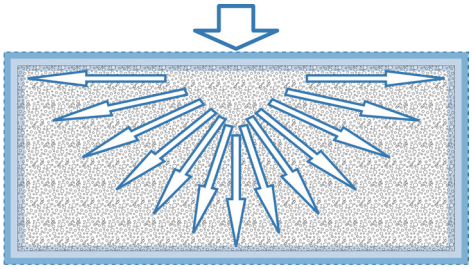


Fig. 4

POSITIVE FIT AND FRICTION LOCK

Through the use of state-of-the-art manufacturing processes, we are able to produce our modules made of AAC-*Plus*™ extremely precisely, with very low tolerances, while maintaining an extremely high quality standard in very large quantities. Only then the MODULE-*Matrix*™ is possible.

POSITIVE FIT

Due to the special design, only one single alignment of the individual module is possible and after the module has been laid down, it is no longer possible to move the module horizontally (see Fig. 1a). The positioned modules thus form a form-fit bond and now lie seamlessly against each other. This horizontal fixation of all modules is continuous from the lowest to the uppermost layer of the MODULE-*Matrix*™ (see Fig. 2a and 2b).

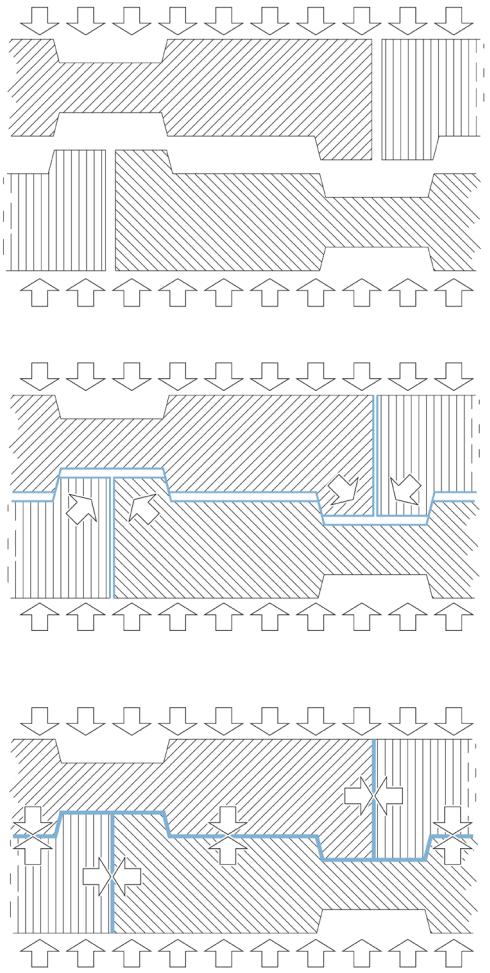


Fig. 1a

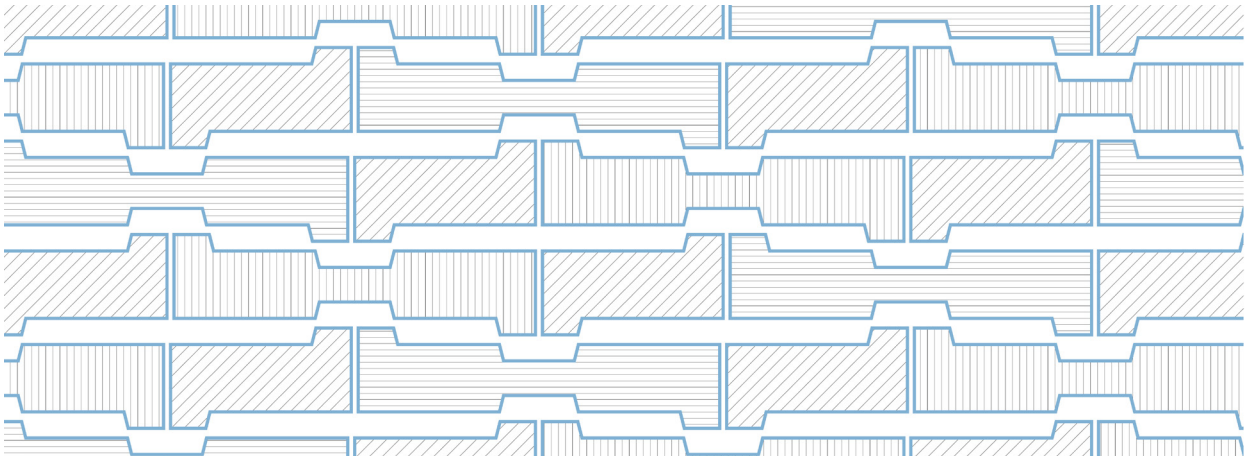


Fig. 2a

FRICTION LOCK

The frictional connection is created by the interaction of gravity, buoyancy and shape, which holds the MODULE-*Matrix*™ together (Fig. 1b). This is achieved by the fact that the individual modules have a relatively high mass, but still a significantly lower density than water.

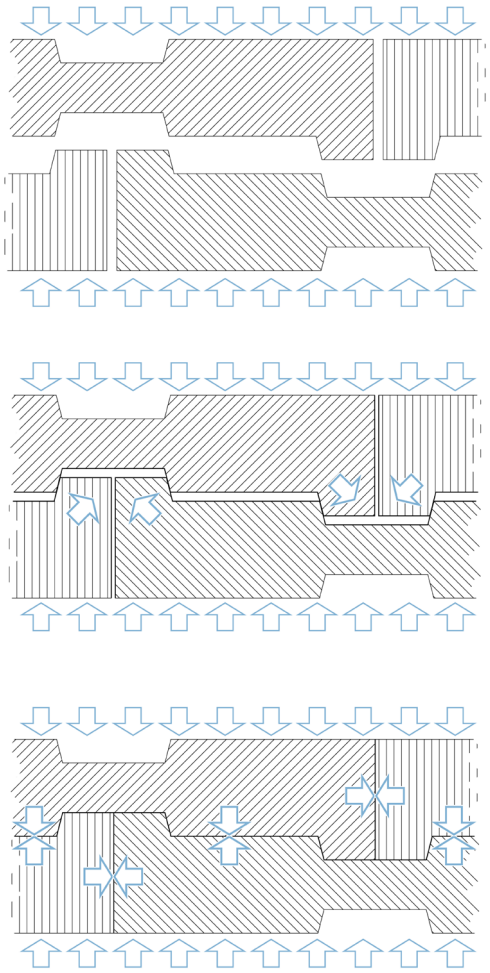


Fig. 1b

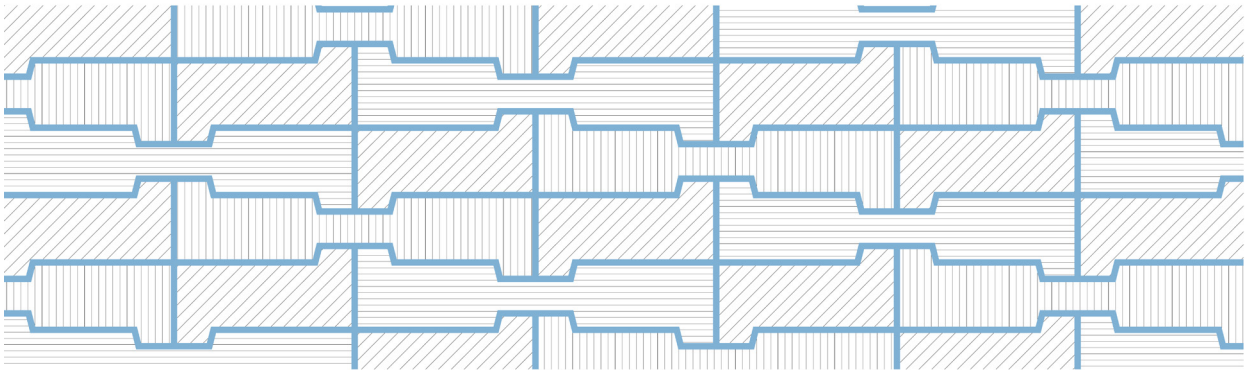
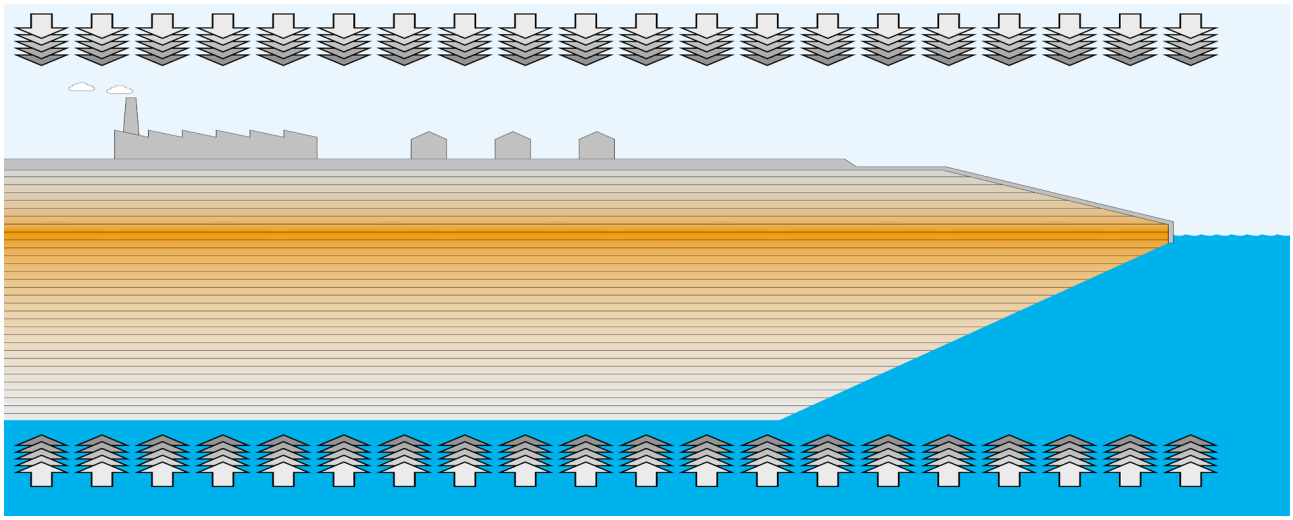


Fig. 2b

SUMMARY

Each module below the water surface contributes to the buoyancy of the MODULE-*Matrix*™. Each module (and each structure) above the water surface contributes to the weight of the MODULE-*Matrix*™. The layers under water of MODULE-*Matrix*™ act with the force of their buoyancy on all layers above. The same applies to objects and modules that lie on top. Every layer over water pushes down. This means that the greatest contact pressure is always between the module surfaces on the top and bottom at the height of the waterline. Here buoyancy and weight are in balance. This pressure ensures the vertical fixation of all layers of the MODULE- *Matrix*™.

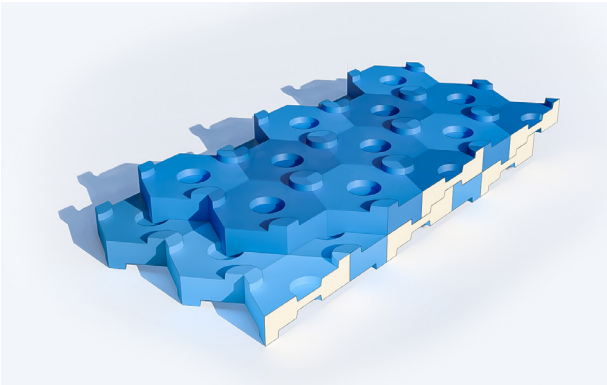


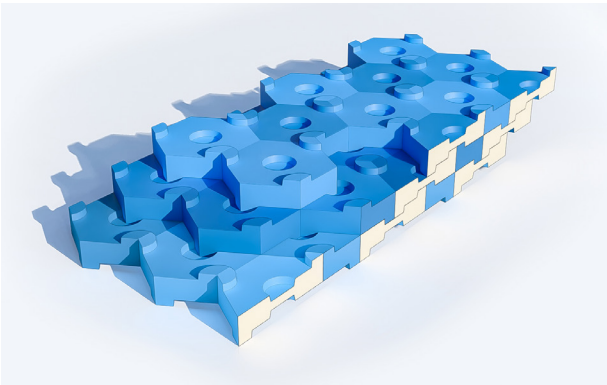
MANUFACTURING TOLERANCES

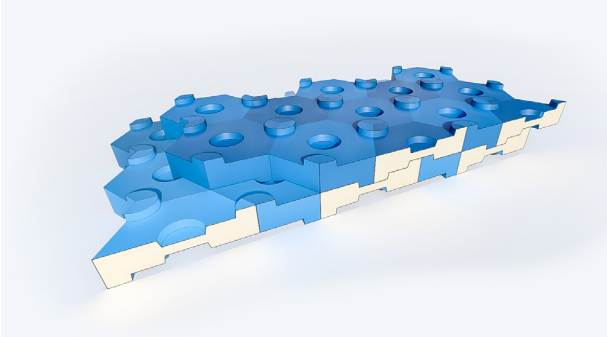
The individual modules made of AAC-*Plus*™, which are protected with DURA-*Protect*™ , are manufactured by us with very fine tolerances. This allows very precise positioning within the MODULE-*Matrix*™. These fine tolerances ensure that the modules always lie very precisely on top of each other and that the shaping elements are frictionally connected. Through the targeted use of fine tolerances, it is therefore possible to, on the one hand join the individual modules together to form a MODULE-*Matrix*™ and on the other hand avoid disturbing gaps in the joints, through which water could possibly penetrate into the connecting layers between the modules.

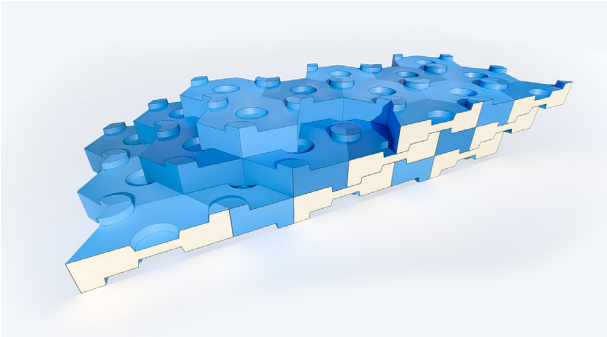
SANDWICH CONSTRUCTION

Due to the additive effect of the MODULE-*Matrix*™ and the consistent use of DURA-*Protect*™ to protect the AAC-*Plus*™ modules, the so-called sandwich effect operates. Depending on the thickness of the MODULE-*Matrix*™ , i.e. how many layers are used, the above-mentioned positive-fitting and friction-locked connections always result in a large number of sandwich layers, which contribute to the tensile strength of the MODULE-*Matrix*™ ; very similar to the well-known plywood panels or the veneer plywood, in which individual unstable, filigree veneers are joined together to form an extremely stable bond through conneti-on technology. However, In contrast to conventional sandwich construction, we do not require separate bonding of the module layers between one another. In our MODULE-*Matrix*™, the „adhesive“ is completely replaced by the combination of positive fit and friction lock as well as the interaction of gravity and buoyancy. Due to the enormous forces acting on the MODULE-*Matrix*™ from above and below and the shaping elements, it is not possible for the individual modules to shift among themselves.





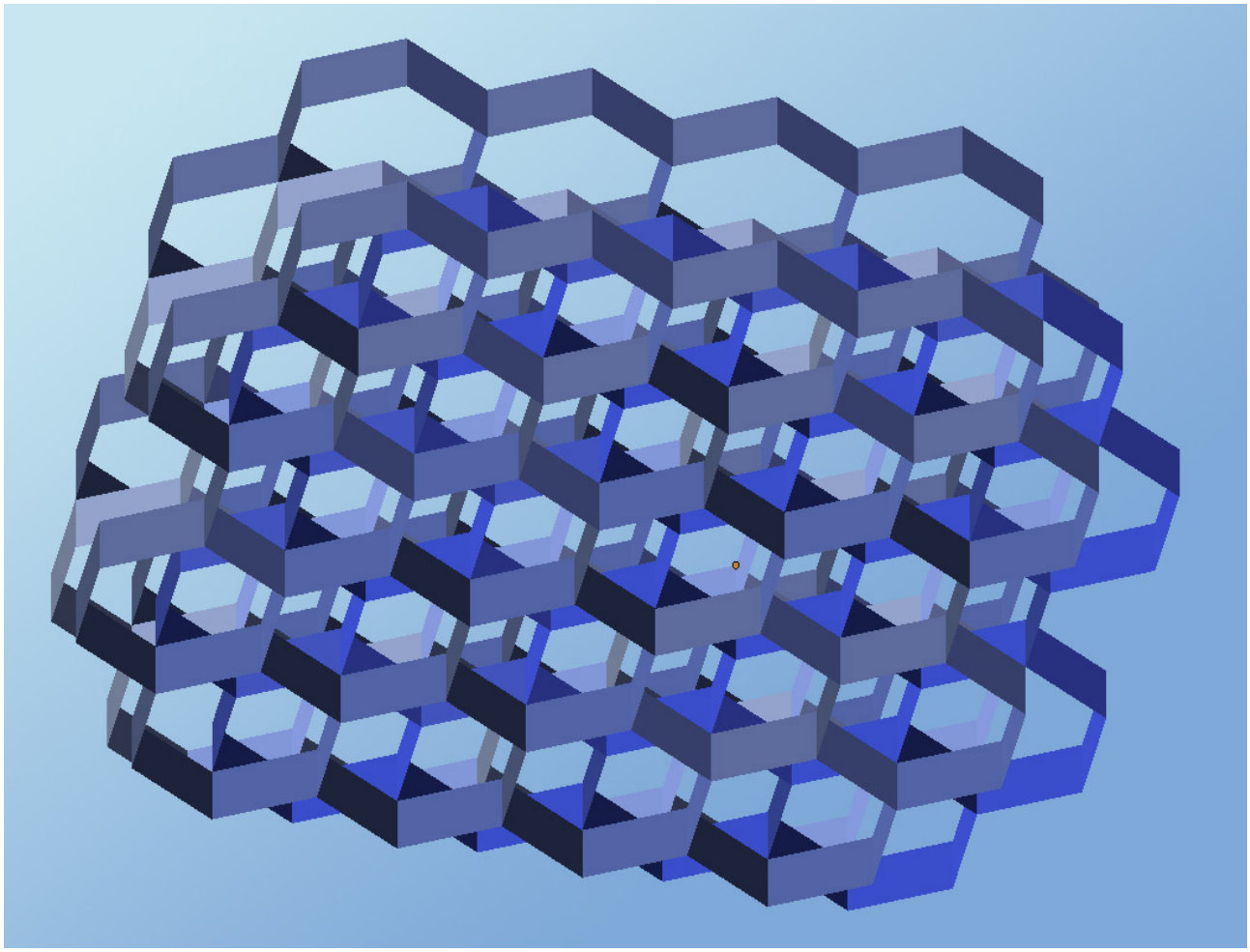




MODULES

NO CONTINUOUS SHOCK-EDGES

Due to the special design of our modules, there are no direct continuous edges to which no adhesion exists. There is always an offset between the modules in the individual layers, which only repeats itself from the fourth layer onwards. This increases the break resistance of the MODULE-*Matrix*™ enormously.



SIZE OF THE MODULES

The size of the modules for the installation of our MODULE-*Matrix*™ has been deliberately chosen so that they can be installed by simply trained personnel with the aid of simple installation devices. But this size is not definite. Of course it can vary. Basically, both larger and smaller modules are possible. In individual cases, however, the cost/benefit calculation must always be taken into account, under the premise of mountability, with or without the use of simple to extremely complex assembly machines.

Small Modules

PRO

- Very easy to handle with simple assembly machines
- Fast extensibility of already existing platforms
- The logistics of smaller modules is cheaper
- Faster production rate and smaller production facilities

CONTRA

- The smaller the modules are, the more expensive they become, due to the higher use of DURA-*Protect*™ relative to the mass
- There must be significantly more single modules used to build very large platforms
- The production process places higher demands on the adherence to finer tolerances

Large Modules

PRO

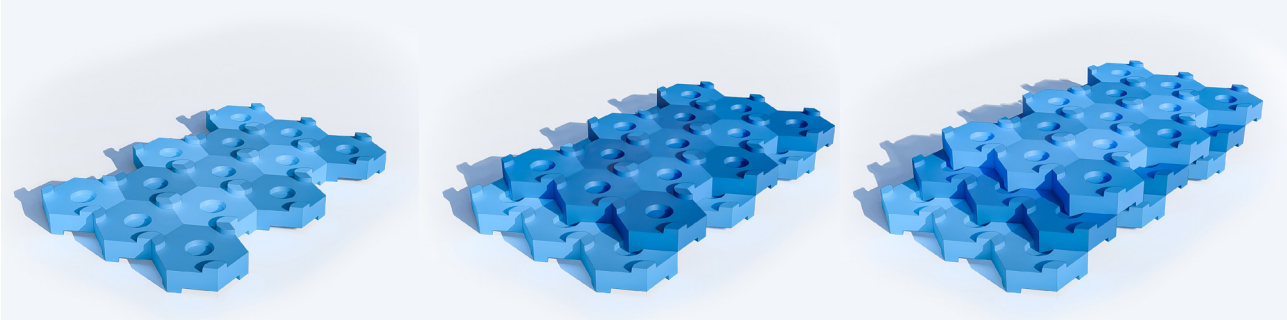
- Fewer modules needed to build large platforms
- The tolerances don‘t add up so much
- The larger the modules are, the cheaper they become due to the lower use of DURA-*Protect*™ relative to the mass

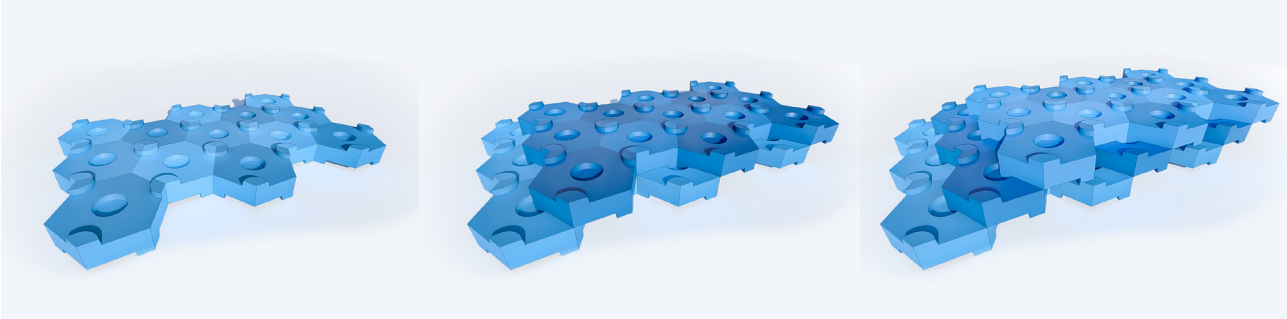
CONTRA

- Modules that are too large, have a considerable mass and thus present an increased risk of injury
- Not to be handled easily and without heavy assembly machines
- Production times higher, due to poor penetration of heat into (heat-insulating) cellular concrete
- Slower production rate and larger production facilities

STRUCTURE

The previous statements mean that any form of screwing, gluing, anchoring and/or clamping of the modules to each other can be dispensed with in order to create a MODULE-*Matrix*™ of any size. Usually, a basic structure with three to six layers is therefore built, first in calm waters and weather conditions that are as moderate as possible, depending on the later area expansion of the respective MODULE-*Matrix*™. This is done with the aid of the simplest assembly equipment, which can be operated by simply trained personnel. The MODULE-*Matrix*™ is then extended upwards, layer by layer, until the initially planned basic load-bearing capacity is reached. When designing the MODULE-*Matrix*™, care must be taken to build compact structures. Long structures or structures with filigree shapes should be avoided.





SCALABILITY & PROTECTION

SCALABILITY OF THE MODULE-*Matrix*™

Objects manufactured from the MODULE-*Matrix*™ can also be extended at any time afterwards. Thanks to the small masses and dimensions of the individual modules, they can be added on the sides, at the bottom or at the top using simple technical aids, or completely rearranged if required - provided that the upper superstructures allow this. However, expansion and conversion measures must be carried out by trained personnel in order to continue to guarantee the safety of the MODULE-*Matrix*™.

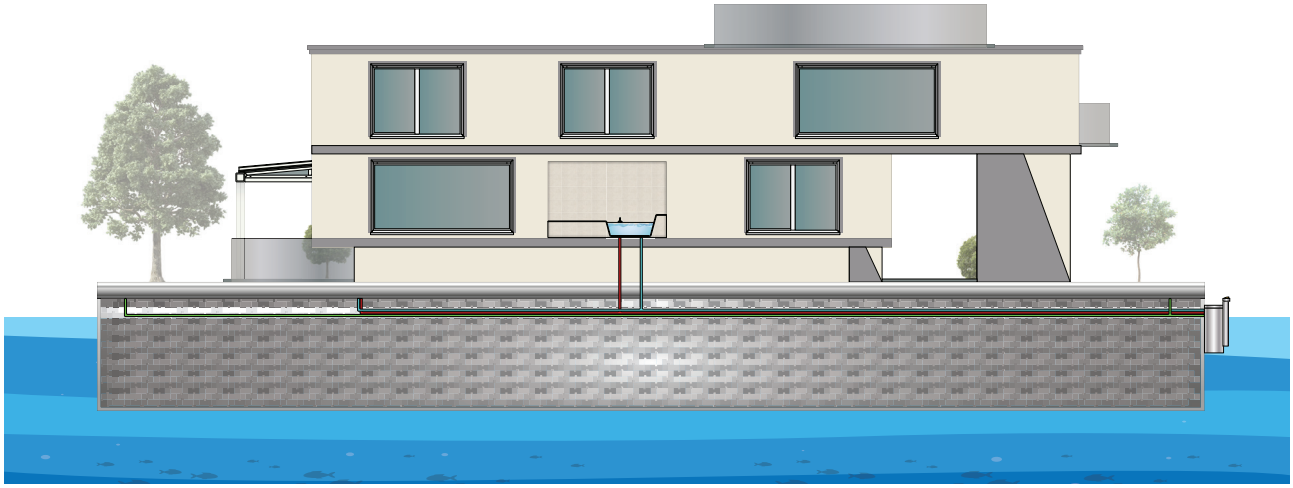
PROTECTIVE LAYERS FOR THE MODULE-*Matrix*™

On the outside and on the surface of the MODULE-*Matrix*™, which can be walked and built on, there is always a protective layer applied to prevent various mechanical stresses on the MODULE-*Matrix*™ itself. These protective layers are adapted to the various requirements arising from the intended use of a specific MODULE-*Matrix*™. If, for example, large buildings are to be built on the MODULE-*Matrix*™, the protective layer must be able to withstand the enormous surface pressure without impairing the form and function of the modules. The same also applies to impulse forces such as departing and landing aircraft. Here, the protective layer must be underlaid with EPS layers, for example, in order to distribute a high impulse into the surface.

CONSTRUCTION RELATED QUESTIONS

PIPE AND CHANNEL STRUCTURES

Pipe and channel structures can be provided within the MODULE-*Matrix*™ or under, in or on the foundation layer. Infrastructure and supply systems are planned to lie on top of the platforms wherever possible. This makes it easier to carry out subsequent conversion and expansion work. When it comes to pure function, there is no need to place these supply systems underneath the accessible or trafficable surface. When designing very large islands with traffic systems, sewers, roads, sidewalks, etc., these infrastructure measures can also be installed under the surface, quasi in the MODULE-*Matrix*™. The corresponding gaps in the structure of the MODULE-*Matrix*™ must also be taken into account.



HOLES IN THE MODULE-*Matrix*™

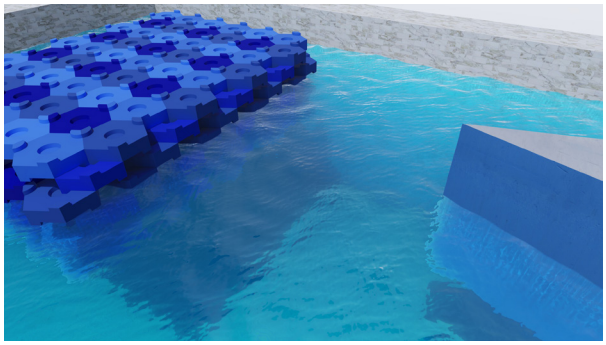
Without our special permission, holes will never be drilled into our individualw modules unless this is planned and intended for the assembly of certain structures. Larger holes can be provided by specially prepared modules or by deliberately omitting modules (see "Pipe and channel structures").

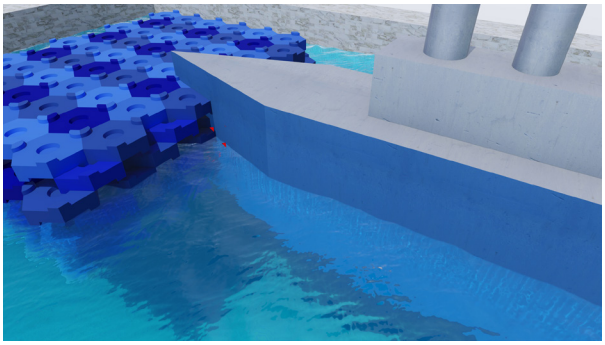
SURFACE FOUNDATION INSTEAD OF DEPTH FOUNDATION

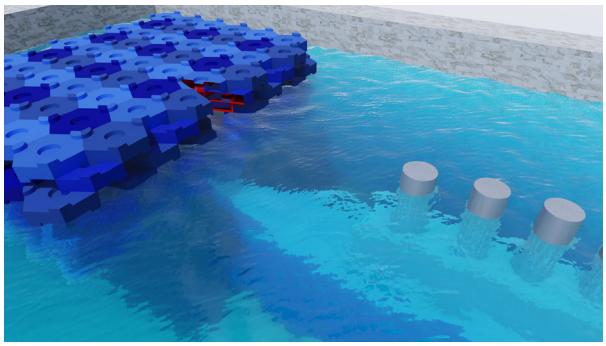
Anchoring of the building objects on the MODULE-*Matrix*™ takes place through flat foundations, which reach into the existing recesses/elevations of our modules and thus prevent a horizontal displacement. Since the subsoil consists of our modules and is therefore dry and solid, there is no need to place foundations on piles, as is usual with sandy or swampy subsoils. In addition, an expensive dampening layer is not necessary for earthquake safety, as it is used in earthquake-endangered areas, since earthquakes don't occur on the water (see "Earthquakes").

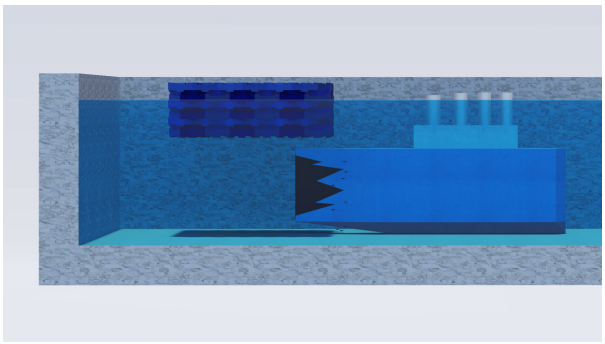
OPERATIONAL SAFETY

Every single module of our MODULE-*Matrix*™ is floatable and waterproof. Modules pressed under water do not soak up water and therefore always rise to the surface if there is no obstacle to them. In the unlikely event of severe accidents with similarly large and/or heavy objects or other serious extreme events, the individual parts of the MODULE-*Matrix*™ would still be floatable. Only actually damaged modules can soak up water and sink, but never the entire MODULE-*Matrix*™.









ANCHORING OF OBJECTS TO THE MODULE-*Matrix*™

In general, any anchoring of objects on the platform is realized by surface foundations, if this is possible (see also "Surface foundation instead of depth foundation"). If it is necessary to provide the anchoring of objects with vertical alignment, these areas are already taken into account when the MODULE-*Matrix*™ is set up. One example for this are offshore wind turbines with great water depths, which are currently an area of great interest and effort for turbine manufacturers. The difficulty at present is the anchoring of individual floating bodies. For large projects with the MODULE-*Matrix*™ and rigid connections between individual wind turbines, it is possible to anchor the entire area instead of each individual floating turbine. We will continue to take the needs of energy manufacturers into account here in the future. If, for example, large office complexes are to be built on a MODULE-*Matrix*™, these can be realized by simple building foundations in the European style. Because the MODULE-*Matrix*™ floats, it is of course earthquake-proof. Therefore, no expensive foundation technology is required (see "Surface foundation instead of depth foundation").

ANCHORING OF THE MODULE-*Matrix*™

All currently known methods for anchoring floating objects can also be applied to the MODULE-*Matrix*™.

ENVIRONMENTAL COMPATIBILITY

Autoclaved Aerated concrete as well as our AAC-*Plus*™ consist of environmentally friendly components. DURA-*Protect*™ and the outer surface will both be environmentally friendly and durable. No toxins get into the sea. Habitats on the seabed remain untouched. The colonisation of the underwater surface of the MODULE-*Matrix*™ by marine organisms is unproblematic and desirable.

PLANTING

The MODULE-*Matrix*™, which is secured by an appropriately designed protective layer, can of course be planted. Special care must be taken when planting on the surface, since exclusively plants with shallow roots can be planted. Plants that drive their roots deep into the soil may cause considerable damage to the MODULE-*Matrix*™. Uncontrolled plant growth must be prevented by suitable measures, e.g. by a barrier layer for organic organisms.

FALSE ASSUMPTIONS

WATER AND DIFFUSION BARRIER LAYER

A watertight hollow body filled with air (e.g. a mineral water bottle with screw cap) will not fill with water after decades. Although water vapour (and other gases) diffuses through the plastic, the atmospheres inside and outside do not exchange gases when the pressures are in equilibrium. For example, water will not diffuse into a closed plastic envelope if there is already air inside with a relative humidity of 100%. The vapour pressure inside counteracts the external vapour pressure and a stable equilibrium is formed. The same applies to our waterproof modules. If they gain weight in the water, this can only be due to a defect in the outer sealing DURA-*Protect*™.

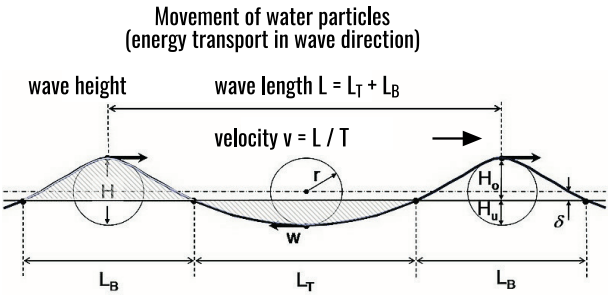
BENDING LOAD DUE TO WAVES

All previous assumptions about the model behaviour of ship models and their conclusions about the actual behaviour of the structures on the original scale are based on empirical values in the field of shipbuilding and in fact do not permit any reliable conclusions about structures that are as broad as they are long due to their design. The kinetic energy of regular waves alone affects our MODULE-*Matrix*™ completely different from conventional ship hulls. Regular waves draw their energy from the wind that blows over the surface of the water. The stronger the wind, the higher the waves (swell) and the more kinetic energy there is in the wave itself. The energy of the waves reaches down to about half the length of the wave, with the amount of energy decreasing exponentially. A wave with a horizontal distance between the wave crests of e.g. 20m reaches a maximum water depth of 10m. The ratio of wavelength to height of the wave will generally be in the range of 100:1 to 50:1. The limit value for severe storms at sea is 7:1 at most. For example, a wave with a length of 70m can reach a maximum height of 10m, whereby its energy is significantly lower at a depth of 15m and no longer perceptible at a depth of 35m. The fear of such a wave tearing our deep-sea platforms apart, because these waves reach below our platforms, is completely unfounded.Generally, our offshore platforms have a construction height of 20m and more. In addition, they have horizontal dimensions of at least 300m x 300m and thus represent a considerable, solid mass in the ocean.

NATURAL DISASTERS

FREAK WAVES

Freak waves are water waves that propagate independently of ordinary waves generated by wind. They can reach thrice the height of average waves at any given time. They come suddenly and without warning as soliton waves or as a group of few waves.



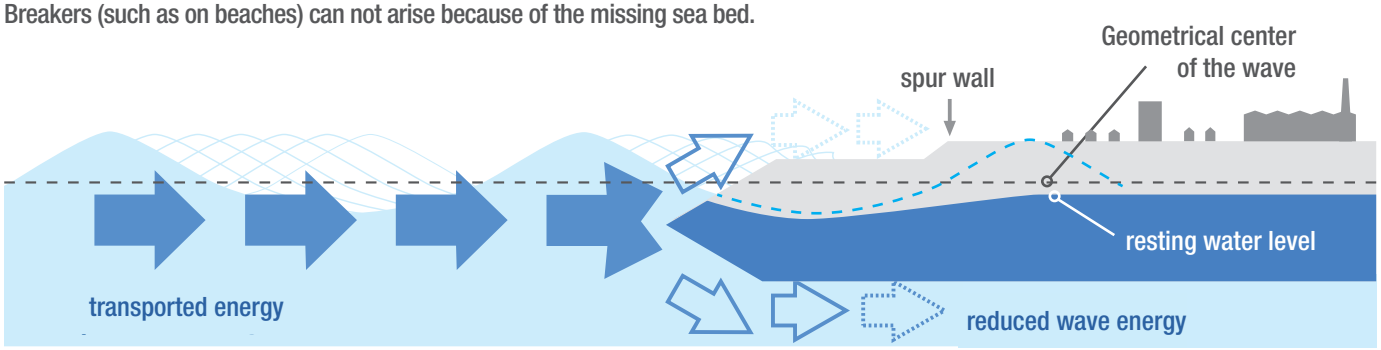
Unlike tsunami waves, they have a very short wavelength and therefore floating bodies cannot ride them but rather cut them. This leads to severe pressure loads, which can exceed the designed loads for ships by a factor of 6.

Freak waves have been in the focus of extensive research since 1995, when the first indisputable evidence of such waves was recorded (on the Norwegian Draupner offshore platform 16/11-E). Previously, any witness reports of freak waves have been questioned.

Due to their construction, all sides of our offshore objects always offer a horizontal wedge for the breaking of colliding waves. Contrary to conventional ships, waves do not collide with a steep ship wall or frontal extensions.

In the event of heavy sea or so-called rogue waves, our wedge edge takes up a very large amount of any deep waves‘ energy, because they get cut horizontally and only a small part of the wave hits the islands “coast“. Of course, this water drains back into the ocean. Additionally a spur wall can protect the buildings on top of the island by keeping away any water emerging the island at bad weather conditions.

The low partial energy of colliding waves is broken down on the edge in short time.
Breakers (such as on beaches) can not arise because of the missing sea bed.



TSUNAMIS

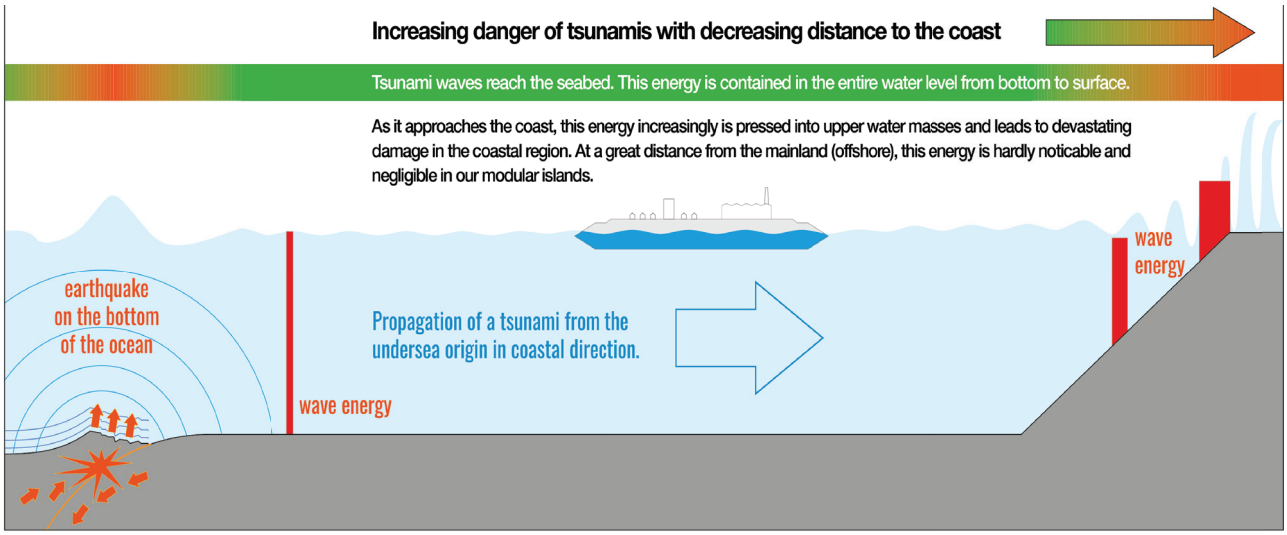
Tsunamis are gravity waves caused by displacement of water.
90% of all tsunamis are caused by earthquakes (other causes are e.g. landslides, volcanic activities or the calving of glaciers). Surprisingly, only 1% of earthquakes also cause tsunamis - because special conditions are required for an earthquake to lead to a considerable displacement of water:

- The earthquake must be strong enough (value on the Richterscale of 7 or higher)
- The earthquake's hypocentre must be near the seabed
- The displacement of the seabed must be vertical (this is most likely the case at the subduction boundaries of tectonic plates)

The primary danger of so-called tsunamis (Japanese: harbour wave/ German: earthquake wave) lies in their energy, which they obtained from an underwater earthquake. Tsunami waves reach to the seabed. Their energy is contained in the entire height of the water from the bottom to the surface.

With decreased distance to the coast, this energy is "pushed" into the upper water masses. This energy is carried by the wave as soon as it hits the shore. There, the energy "piles up" leading to the emerge of a single very large wave and several small ones, which have very destructive effects.

With great distance to mainland, that energy is barely noticeable and can be neglected with our MODULE-Matrix™. As with all ships and our floating islands, this kind of wave simply flows under our objects and therefore neither poses any danger to the object itself nor its extensions.



EARTHQUAKES

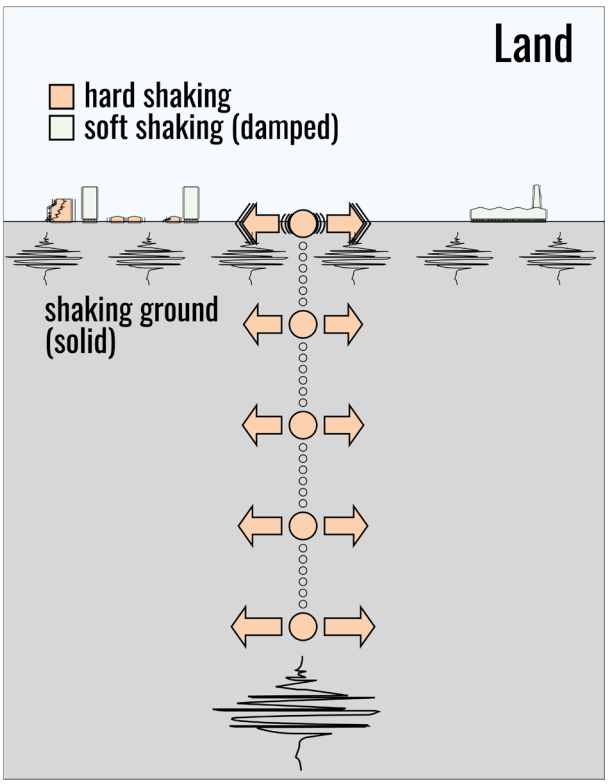
Earthquakes are particularly frequent in certain regions of the world. The most vulnerable are those at the edges of tectonic plates. Earthquakes often cause major casualties among the population of affected countries. This affects human lives, buildings and infrastructure in equal measure.

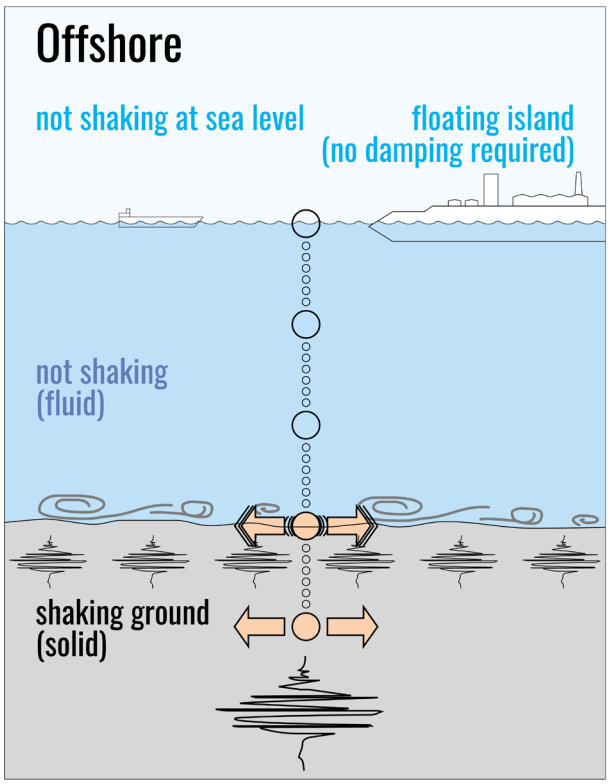
As already mentioned, only 1% of all earthquakes trigger the dreaded tsunamis due to their strength, vertical orientation or proximity to the seabed. Most earthquakes are either significantly weaker or predominantly horizontal.

On land, earthquakes - regardless of their orientation - are devastating to a certain magnitude or near the epicentre.

All earthquakes with a horizontal orientation - i.e. when continental plates shift horizontally against each other - are normally not perceived on the high seas. The reason for this is that the masses of water above do not move with the seabed, even at a short distance from the source of the earthquake, due to their mobility and inertia.

On the high seas, earthquakes pose no threat to human life, buildings or other infrastructure on the surface of our floating platforms. Our building foundations do not require any special precautions for the damped transmission of motion by moving earth masses, as required on land.





TYPHOONS, HURRICANES AND CYCLONES

Whirlwinds such as typhoons, hurricanes or cyclones can cause enormous damage to surface structures. one knows the images showing demolished signs and roofs and the damage that the swirling debris can cause. It cannot be ruled out that a whirlwind that sweeps over our platforms will cause the same damage to its buildings. Loose earth is whirled up and carried away. Light roofs that rest on cavities and have nothing to oppose the suction are damaged and swirled around by such forces of nature.

However, this does not affect the MODULE-*Matrix*™. Neither the modules that contribute to the buoyancy nor the protective layers and foundations applied above the modules can be lifted and removed by hurricanes. The ratio of surface to mass is too high and there are no cavities that make lifting possible in the first place. In addition, care must be taken to ensure that the water masses carried by storms can flow from the platform back into the sea.

COMPARING THE MODULE-*MATRIX*™

Safe from...

	Land	Ship	MODULE-*Matrix*™
Tsunami	✗	✓	✓
Earthquake	✗	✓	✓
Freak Waves	✓	✗	✓
Sinking	✗	✓	✓
Typhoon / Cyclone	✗	✓	✓