FREIGRAD®

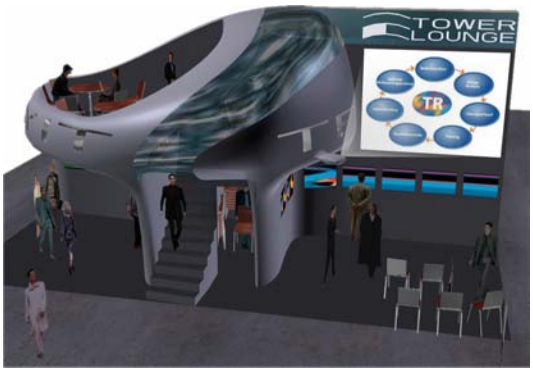
INDIVIDUAL ARCHITECTURE VIA MASSPRODUCTION

Individual Architecture via Mass Production

Although it may sound paradoxical to create individualised architecture with a mass-produced article, with the Freigrad® System we are offering you a trend-setting, modular construction system that pushes the boundaries of systematic-construction and offers new, interesting possibilities with cost-effective building techniques for those whose clients have high standards for interior design and structural innovation.

Surface covering of a house

In this way it is possible to create biomorphic forms. The materiality and haptic quality of surfaces can be freely designed. The construction can not only be sheathed with flat materials like wood, glass or stone, but also with textile membranes. Translucent areas, like windows in the roof or even walls can be realised at every position of the space.

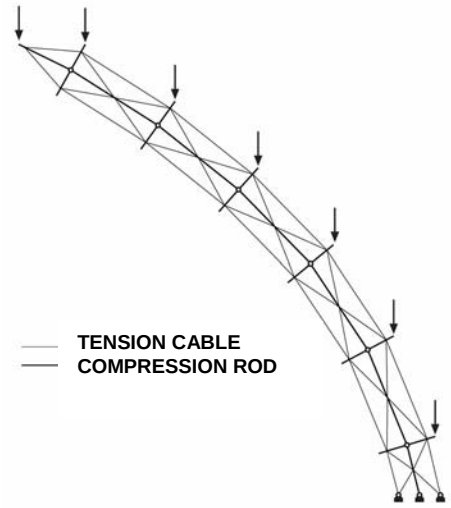


Textile stretched around a booth

Today, the needs of a construction can change practically overnight. Therefore, the Freigrad® System can also be expanded or modified without major investments in time or materials: Only the areas to be modified are taken out and then created anew, as is most appropriate.

The entire construction can even be transplanted in a cost-effective fashion. For example, the entire form can be dismantled to its components and folded in order to be built again at a different location.

The newest and most important aspect of the Freigrad® System is the differentiation between compression and tensile construction elements, which has to date found no application in systematic-construction styles even though it is a common practice in reinforced concrete techniques. This application enables the production of a skeletal construction that is extremely light, incredibly flexible in design considerations and complies with the statics of the construction - ultimately minimising material use.



Static system

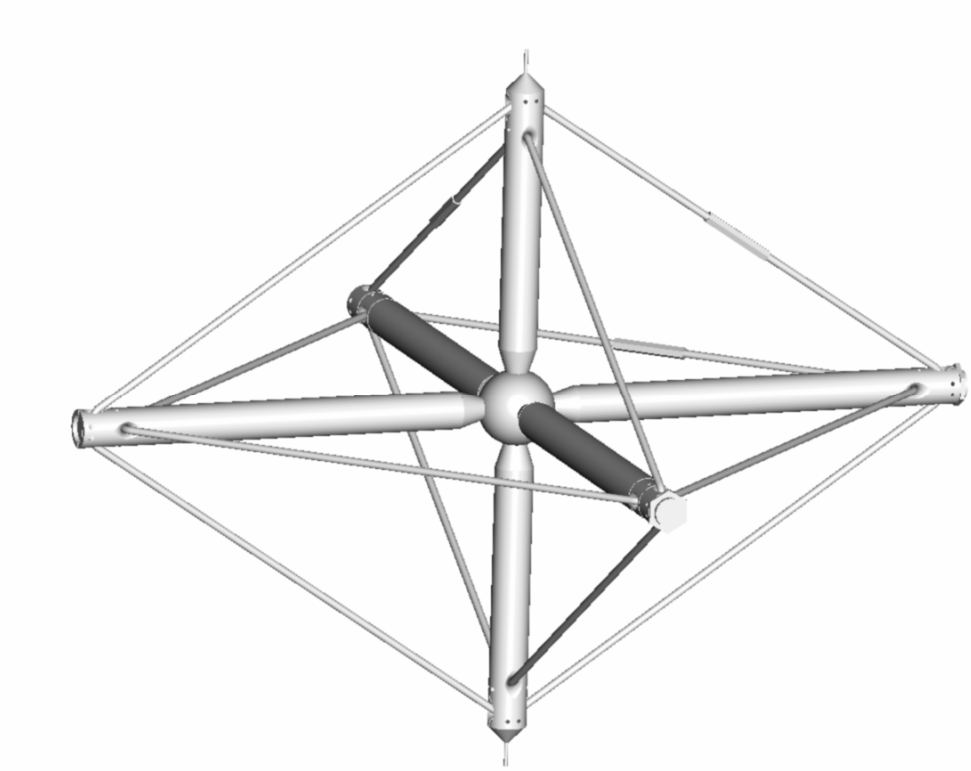
The construction principle is scalable and appropriate for a wide spectrum of applications. In addition to exhibition and booth construction, general house construction and even large halls can be realised.

The high flexibility and broad range of applications of the Freigrad® System is made even more attractive by the integration of currently available components like steel tubing and steel cable, and the production uses currently accepted best-practices and does not demand full automation.

Bionic Principles of the Freigrad® System

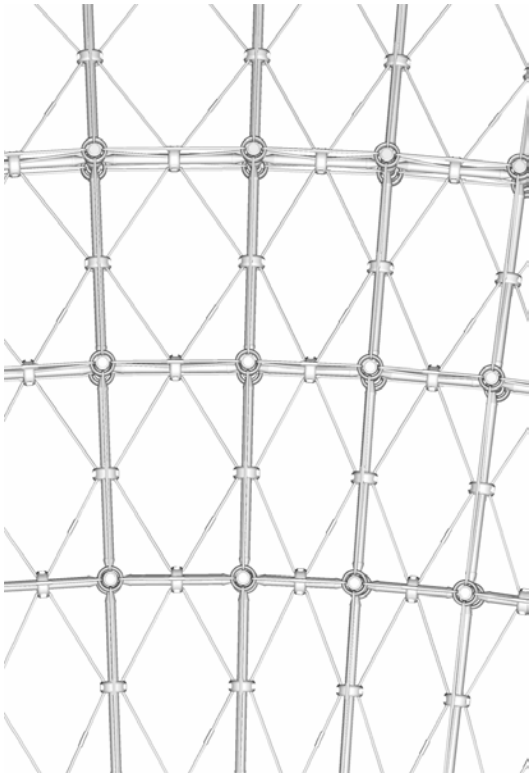
The Freigrad® System is based on a very simple and basic principle of construction: The components of a ball-joint are only connected to each other with tension cables, as in human joints which are built with tendons attached to muscles. In tensioned conditions, the joints become form-defining network cells, which in their totality find reference to bone structures on the cellular level and create a stable meshwork. As can be seen in nature, this principle is scalable according to application and dimension of the project.

Knee joint



Tensioned network cell

Cellular bone network

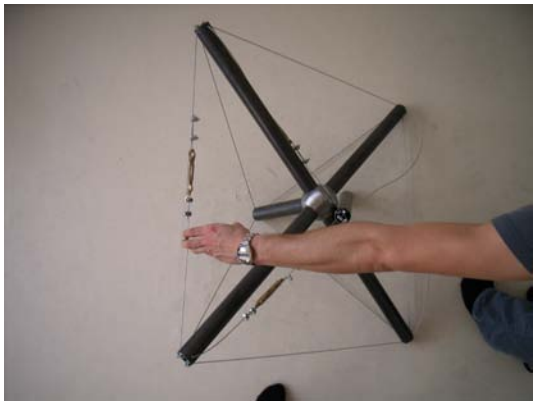


Cellular construction design

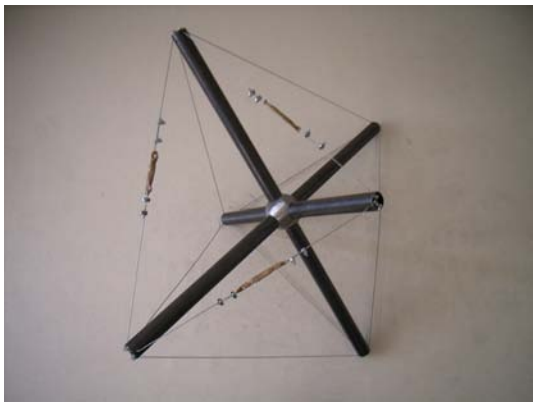
Construction of the pre-formed cell

The transportable packet is composed so that the rods are arranged according to their orientation in their final constellation. During testing, trained persons have assembled this single network cell in around 45 seconds.

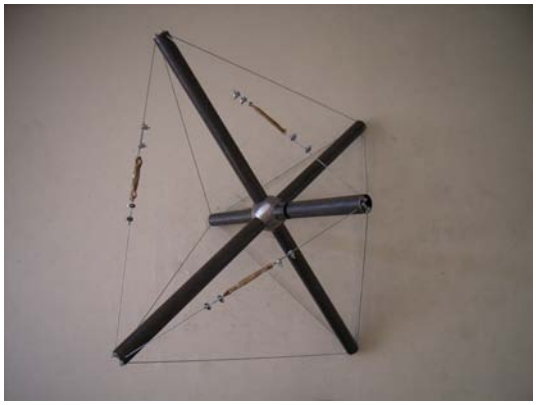
In the first stage of construction, three rods are connected to each other so that the attached tension cables create a triangle on the floor. In this phase, the construction is stabilised with light pressure on the ball.



In the second step, all rods except the final one are placed on the ball.



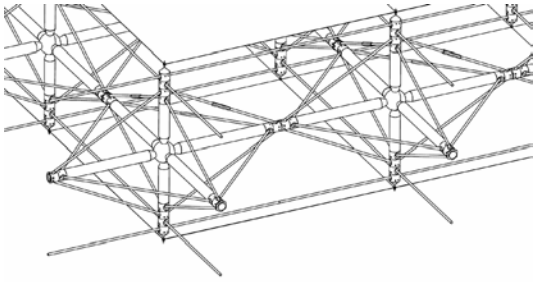
The last rod is placed in this next to last step. Although the tensile cables are not yet tensioned, the construction is already self-bearing.



In the last step, the final rod is extended to its ultimate length. In this way, all tensile cables are simultaneously tensioned. The cable tensioners shown in these images were used for proof-of-concept testing and are not intended for application in production runs.

Assembly of the complete construction

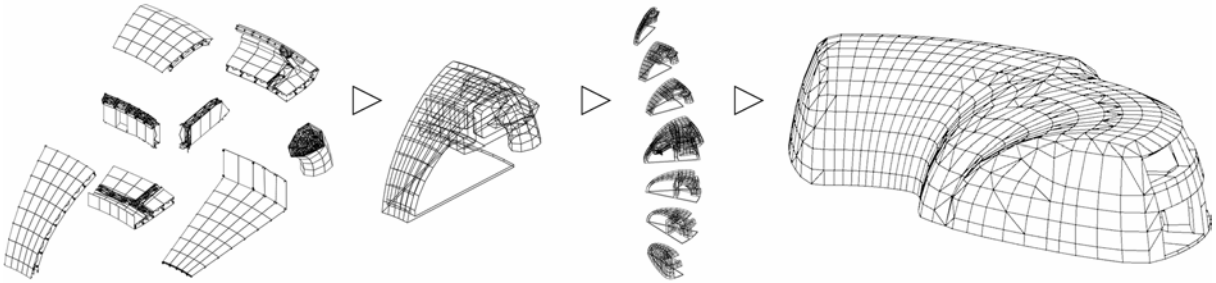
The assembly of a construction form is comparable to laying bricks for a wall: The individual tensioned network cells are placed on and next to each other and then bound together with tension cables. The pre-tensioning is achieved with short connectors between the cells. In this fashion, a stiff skeleton is created and maintained at every step of the construction, regardless of the individual design.



Assembly phase in construction

When creating forms with foundations, construction platforms are not necessary. As can be seen in the image below from our proof-of-concept testing, the downward forces exerted from one person can be transferred across the form without critical distortion.

It is also fully possible to pre-construct entire building components off-site, including technical infrastructure and surfacing.

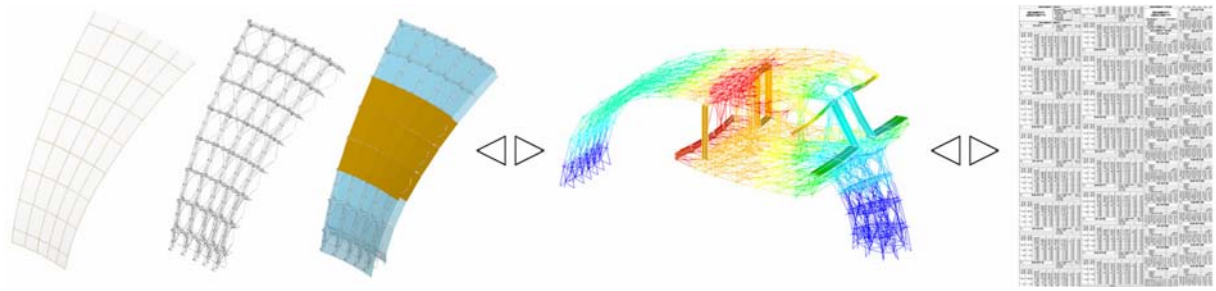


Individual building elements, segments and complete body

Computer Integrated Manufacturing und Collaborative Engineering

The Freigrad® System is available to all development firms via our independent software. Planning with our Freigrad® CIM Tools is relatively uncomplicated and unifies all architects, engineers and controlling managers with production processes.

The architect's 3D-form, in whatever shape it takes, is changed to a mesh that is arranged according to the positioning of the individual network cells. Then, the materiality of the surfacing is determined and the dataset is given to the engineer. At this stage an FEM model is made in order to optimise the total statics in regard to wall thickness – thus reducing material consumption to an absolute minimum. The complete list of components is available to controlling at every phase of the planning, including prices in real-time. After the planning is complete, the dataset is used to organise the production of the individual components. Every cell and every surface element is then entered into a list, created in series and pre-formed.



The workflow: meshed surface <> FEM model <> parts list and production table

Overview of the Freigrad® System-Characteristics and Competition Analysis

Because of its new characteristics, the Freigrad® System has no direct competition on the market. For comparison however, the newest Mero® system “Arcus“ is used, which is available for stand-construction in the same price class.

Systems and Functions	Standard Systems	Mero® Systems	Freigrad® Systems
Design freedom in form creation	no	limited	**yes**
Prefabrication of construction components and conglomerates	no	**yes**	**yes**
Foldable nature of complete building sections for transport	no	no	**yes**
Prefabrication of cell-elements	no	no	**yes**
Foldable nature of cell-elements for transport	no	no	**yes**
Load-bearing layers with self-bearing forms	no	**yes**	**yes**
Load-bearing layers independent of form	no	no	**yes**
Multiple storeyed construction with multiple layers	no	**yes**	**yes**
Multiple storeyed construction with one single layer	no	no	**yes**
Light construction via seperation of compression and tensile components	no	no	**yes**
Modifiable according to the statically required height of a layer	no	no	**yes**
Modifiable form	no	no	**yes**
Free choice of surfacing	limited	**yes**	**yes**
Various functions can be combined	limited	limited*	**yes**
One single design element for walls, ceilings, roof and facade	no	no	**yes**
No requirement for automatisation	**yes**	no	**yes**
Compatibility with existing constructions and other systems	no	limited	**yes**
Planning software	limited	no	**yes**
Independent collaborative Engineering	no	no	**yes**

*via diagonal rods

The most important advantages offered exclusively by the Freigrad® System are:

- Absolute freedom of design
- Absence of need for diagonal rods
- Foldable nature and pre-construction element meshworks possible
- Especially lightweight
- High force transmission capacity
- No need for automation
- No special components for multiple storeyed constructions
- Broad range of applications and scalability
- Fast construction and dismantling processes
- Simple to modify
- Collaborative engineering und effective planning

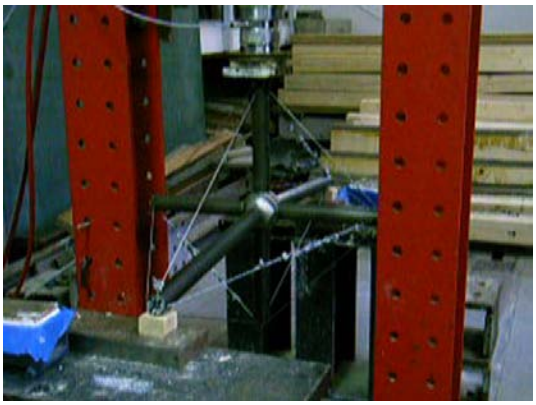
The following characteristics show the uniqueness of this product:

- No normed lengths or fixed meshes (profile and connection angles)
- Form modification only via varying profile lengths
- Constructive distinction between compression and tensile components
- No screw-type systems
- One single universal detail for a myriad of applications

Information about the Freigrad® GmbH i.G.

The Freigrad® firm was founded out of the environment of Bauhaus-University Weimar as a self-bearing company.

The development of the system began parallel to the Architecture Thesis work done by Dipl.-Ing. Benjamin Wernike. In addition to the inventor, the founding team is composed of civil engineer Saad Ahmed Sadalla, salesman Stephan Fricke as well as programmer Patrick Levin.



Proof-of-concept model undergoing structural load testing

We have direct contact to local scientific and engineering institutes, to the faculty of Machine Construction at the Technical University Jena as well as relevant partner firms in order to further develop the system and its software.

The proof-of-concept test shown to the left displayed an initial load-bearing value of 400kg/m². This value is expected to increase with the further development of the system as time goes on.

After our testing on cellular networks is completed, we will advance to the final proof-of-concept stage by constructing a prototype Freigrad® pavilion.

We hope to have inspired you with this brief overview of the new possibilities and uniqueness of our product. Should you require further information about our firm and references, potential cooperative ventures or our other products, please feel free to make an appointment with one of our representatives.

We look forward to assisting you in realising great designs without compromise.

Your Freigrad® Team

Mobile: +49.179.5941773
Tel.: +49.3643.479455
Fax: +49.3643.479456
E-mail: info@freigrad.com
Web: www.freigrad.com