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BUGA
(FEDERAL GERMAN GARDEN SHOW)
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The 20th Federal Garden Show in Frankfurt used the motto "An Experience In Blooming". It aroused great interest not only amongst floriculturists, but also because of the creative use of architecture which has become possible with modern textile structures.

The pathways through the Federal Garden Show passed by numerous textile structures made from a total of 45,000m² of PVC coated and surface sealed fabric.

Climatic conditions in Germany do not allow visitors to enjoy the parks and exhibitions without having to regularly look for shelter.

The task was to erect buildings which

- were mobile and could be dismantled and rebuilt after the event
- did not disturb the natural environment
- met the tough building regulations
- and which blended in with nature through their structural shape.

The BUGA (Federal Garden Show) is a good example of successful co-operation.

Pohl, the architect from Frankfurt gave Carl Nolte GmbH the task of co-designing gardens with specific themes, using various textile structures made from membrane materials, pvc/pes, foamed lattice-type woven textiles and awning fabrics.

With these textile materials, ten different garden installations with walls, roofs, geometric figures, sails and roof-linings in the most varied of colours were designed.

Hammersteiner Kunststoffe GmbH (Haku) was given the task of producing the PVC coated Trevira fabric with surface sealers and Karl Hocker Stahlbau GmbH specialising in the manufacture of mobile and textile-covered buildings, was given the job of supplying the structure.

Hocker textile-structures covered the Winter Olympics in Calgary, and Australians celebrated many of their Bi-centenary celebrations under Hocker structures.

Hocker applied the experience acquired over the decades in the area of easy and quick assembly and transportable

structures to the design of the textile halls erected at the BUGA-Centre.

A total of approximately 20,000m² of ground space was covered. The designs and calculations were carried out by 5 in-house engineers in three months.

Manufacture of these halls took three months in the plant in Bad Salzuflen. A total of approximately 90 tonnes of aluminium, 20 tonnes of steel and approximately 45,000m² of coated Trevira-High Tenacity woven fabric as well as other materials such as wood, glass and carpeting were used during manufacturing.

The buildings were designed in such a way that at the end of the BUGA they could be re-constructed in other combinations. A modular construction system developed by Hocker makes it possible to change the amount of ground surface covered, for example, by lengthening or widening the existing construction frame.

Over a period of 2 $^{1}/_{2}$ months, 15 assemblers erected a total of 62 textile halls in various sizes and structural shapes on the BUGA site.

The halls took approximately one month to dismantle at the end of the BUGA.

All the halls had to be erected without concrete foundations and only on steel flooring slabs fastened with ground anchors in order to leave no trace once the exhibition was completed.

(Normal tension structures had the disadvantage that the periodically high stresses on the membrane would need to be relieved using supporting pillars and cables through corresponding concrete foundations in the ground.)

Hocker uses a frame for membrane constructions which relieves the stress and is diverted into the ground via the floor slabs and anchorage around the perimeter of the building. The requirement made by the BUGA was that the building should blend in with the environment. Hocker assembled the groups of buildings together combining mushroom-shaped roofs and exhibition halls with gable ends to resemble the massive tops of deciduous trees, and other buildings with pointed silhouette and low-reaching branches resembling the shapes of conifer trees.

In these increasingly mechanised and fast-living times there is increasing uncertainty when it comes to long term planning and "permanent" structures. Therefore temporary or

mobile structures will play a more significant role in the future. This is of course particularly true of fairs and exhibitions, but is also expected to increase in other industrial and commercial applications.

Increased demands can also be met through the further development of membrane technology. The projects must be functional and economical, but also architecturally attractive.

The surface of the membrane needs not only to look good in the short-term, but also in the long-term, and also be available in colours. The surface needs to be antisoiling and be easily cleaned.

Haku developed a PVC coated polyester material with a PVDF lacquer or surface sealer. This finish is one of the newer technologies being applied to PVC/polyester fabrics to greatly improve the cleanability of the surface.

Exposure plays a particularly important role in so far as different demands also require different fabric and coating concepts. The transparency can vary between fifty and zero per cent – depending on whether a transparent or highly pigmented coating-compound or a close or open weave is used.

At the same time, the reflection of sunlight can be controlled through the type of pigment used, for example, in order to avoid a green-house effect, which would occur in the case of high levels of transmission of sunlight.

Certain design solutions make good ventilation of the textile structures possible as some materials are generally impermeable to air. On average it has a thickness of approximately lmm and has practically no insulating effect. Through the development of a double-layered construction it is possible to achieve the heat insulation factor of double glazing without excessively reducing the transparency.

The question of durability of these types of roofing materials can obviously not be answered in general terms. Depending on the use and the construction site it could be 15 or even 25 years under European conditions. (In a licence certificate of the Ministry of the Interior of the state of North Rhine-Westphalia dated 19th January 1980, its durability was stated as being at least 12 to 15 years based on the state-of-the-art technology of that time.)

The correct woven textile construction and type of coating needs to be chosen depending on the construction site and application in each case. The high specific tensile strength of the Trevira fibre material, approximately

100 kg/mm^2, is equivalent to the stronger types of steel, yet the weight in comparison to steel is five times lighter. Because of the excellent technical properties in regard to tensile strength and low specific weight, constructions spanning distances of over 100 metres are possible. The membrane roof construction over Expo 88 in Brisbane last year is an example of a large free-spanning surface structure.

A coating mixture which provides a high degree of UV-resistance and heat-resistance is used when constructing a textile structure in tropical areas, whereas a comparable structure in Canada or Europe under conditions of extreme cold would be required to provide resistance to lateral bending, even in the lowest temperatures.

All of this experience was used in meeting the high demands of the textile structures required at the BUGA Centre.