

SIRQUE: a new permanent circus tent with insulated double layer membrane in Nexon - France

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ABSTRACT

The paper describe the design, fabrication and erection of the permanent circus tent with isolated tensile roof of the National Circus Centre of Nexon Nouvelle Aquitaine "SIRQUE". It is installed in the national heritage site of the castel of Nexon (France). The design of the building began in 2018 and has been delivered in 2021 (Fig 1 and Fig 2). The size of the circus tent is 40x18m; height is 11m. The floor surface is 650sqm; 3D surface of the membrane is 1100sqm. The architects designers of the project is ADH Architects, Benoit Doahzan located in Bordeaux, France. Abaca is the project engineers for the steel structures, roof membranes, tensile and steel walls, grandstands. Membrane manufacturer is VSO, Artigues près Bordeaux, France, and steelworks has been realized and installed by SIRC, Bischwiller, France.

The supporting frame is composed of parallel steel arches ending, in one side, by a spherical part and in the other side, by a large oblique canopy protecting a rear technical area. The PES/PVC membrane takes a smooth doubly-curved form between the arches. The form finding of the membranes has been realised using FDM method [1] under AutoCad-ARX home-made software and the structural analysis under climatic loads has been calculated using cable net equivalent model with AutoDesk RSA non linear cable elements. The steel frame has been also computed using Autodesk RSA software.

The ventilated isolated skin adopted with a 140mm Rockwool layer is described including the venting system of the enclosed air lamella. Three components realize the roof :

First a lower membrane made of 702 opaque Ferrari in one single piece tensioned by lacing on the peripheral zone (Fig 3). Specific air vent has been realised in the lower zone of the membrane to allow the air passage in the plenum.

Second, a layer of isolation fixed by waterproof bolts on a second 700g/sqm membrane has been installed, in 16 individual parts, by lacing on hollow section on arches (Fig 4)

Third, a 702 Ferrari finalize the complex, managing a 10cm space with the isolated layer and a venting zone in the upper part to allow air circulation and avoid condensation flows (Fig 5).

A drainage collector, welded upon the isolated layer, can collect residual condensation when appears, and allowing evaporation during day, with the help of (1) at the bottom, a perforated sheet of metal and (2) at the top, Ferrari grid fabric FT381.

Following the steel frame angle, flat clamped tensile membrane of entrance halls are described.

In addition, technical doors, built from lightweight steel frame, has been covered by flat clamped tensile membrane and equipped inside by reflecting thin isolation product. With respect to the prescription of the fulfilment, with a total thickness of 5cm of the 3 layers, the thermal resistance of a 12cm Rockwool isolation is reached.



Fig 1 : Outside view of the permanent circus tent

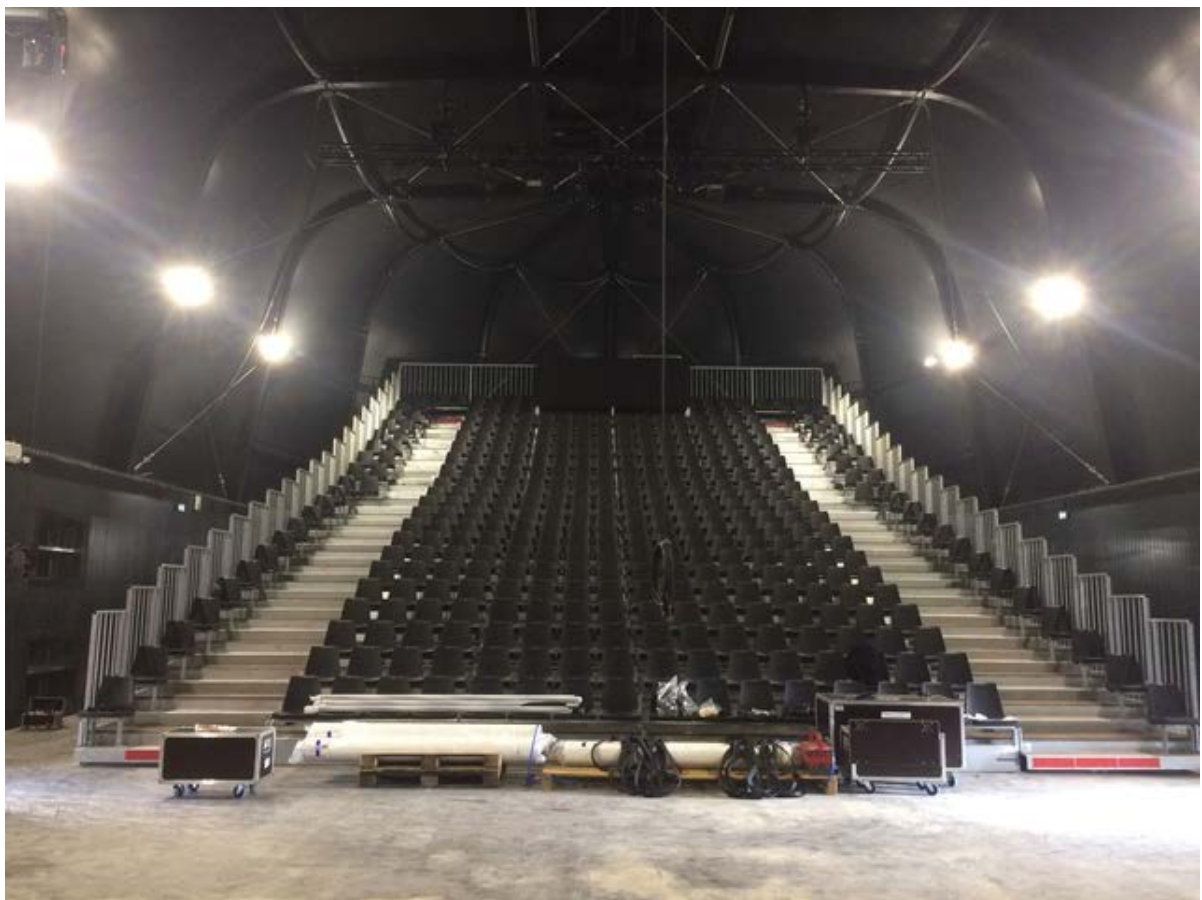


Fig 2 : Inside view of the permanent circus tent



Fig 3 : View of the steel frame and first layer of membrane during installing (Video caption)



Fig 4 : View of the second layer of membrane



Fig 5: View of the third layer during installing (video caption)

REFERENCES

- [1] H.-J. Schek, "The force density method for form finding and computation of general networks," *Computer Methods in Applied Mechanics and Engineering*, vol. 3, no. 1, pp. 115–134, Jan. 1974.