Proceedings of the IASS Annual Symposium 2019 – Structural Membranes 2019
Form and Force
7 – 10 October 2019, Barcelona, Spain

FIXATION DETAILS AND MEMBRANE ASSEMBLY

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Abstract

Develop tensile structures projects implies from the conception of design to define the possible general solutions for any architectural approach without having to reach a final detail in an initial stage of proposals. In order to consider the most efficient installation and assembly process in this case, two important points must be considered; use the least amount of structural elements and the highest use of membrane pointing to the basic concept of lightweight coverage. Also within these 2 points consider the optimization of manufacturing and processes. In the case of the membrane achieve the least amount of repetitive modules and in the case of the structure look for the most modular and efficient geometry possible that can be adapted to any regular space or irregular.

Key words: initial geometry, optimization, assembly process

1. Introduction

The project "Polideportivo" I.E Republic of Argentina located in the city of Chimbote - Peru, is a project executed by the company COMERCIAL INDUSTRIAL DELTA S.A (CIDELSA) conceived in 2015 by the Arch. Aurora Pérez, head of the architecture area. The development begins in 2017, the design consists of a geometry of successive arcs rotated in its plane one after the other which define 2 main spaces joined through a central coverage.

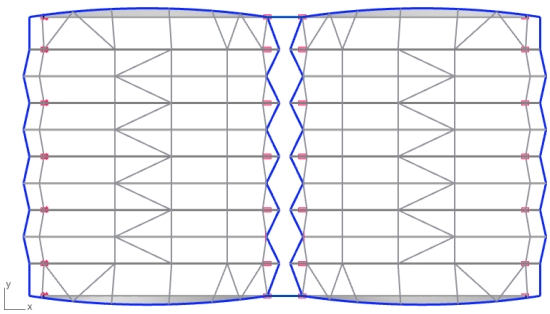

Figure 1: Design plant

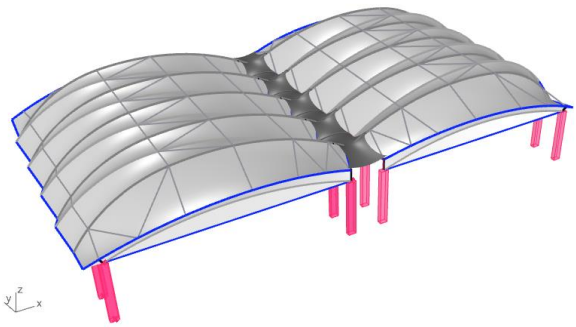

Figure 2: Isometry

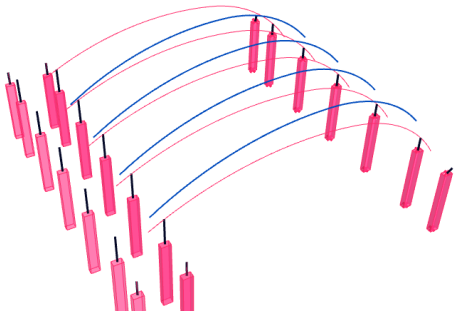

Figure 3: Main arches

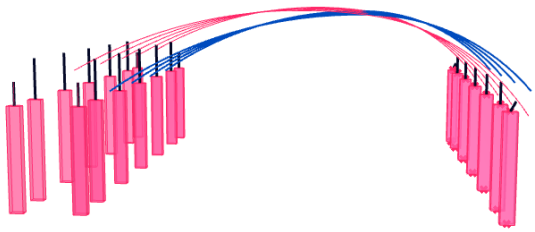

Figure 4: Rotation axis of intercalated arcs

The membranes were defined in typical sub modules that allowed to organize the elaboration of the larger blankets more quickly considering also a tentative assembly.

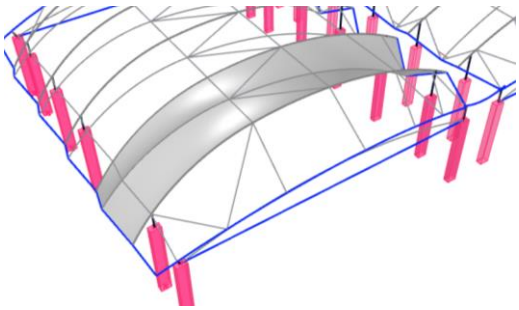

Figure 5: Typical module A with intermediate central cable

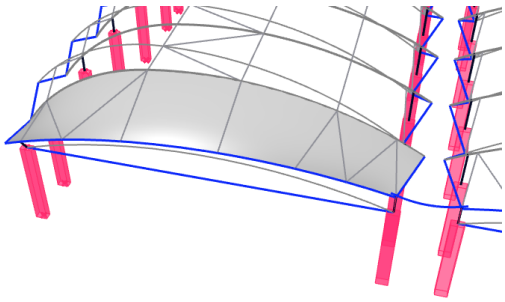

Figure 6: Typical lateral module B

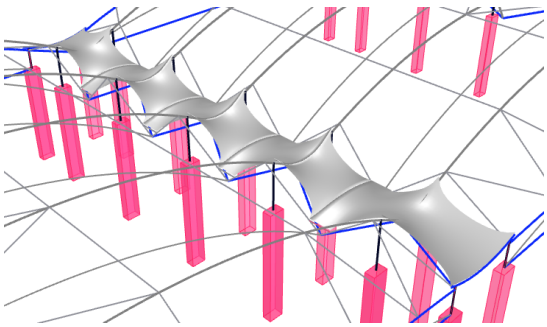

Figure 7: Central module C

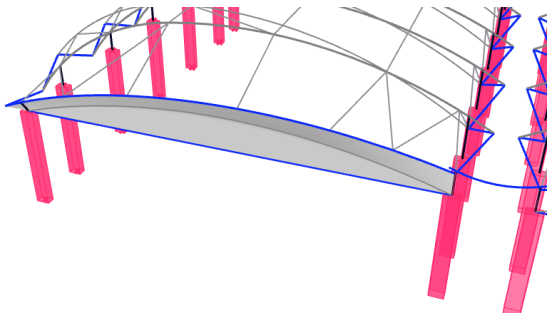

Figure 8: Typical lateral module D (vertical enclosure)

When passing to a stage of development, the possibilities of fixing the membrane are evaluated, being able to be above the structure or below. The engineering area, considering the proposed initial geometry, works in conjunction with the architectural area for the most suitable types of connection of the structure as well as the possibilities of assembly of the membrane. In this stage the final structure is defined where some additional structural elements may appear as well as the system for fixing the membrane in the structure.

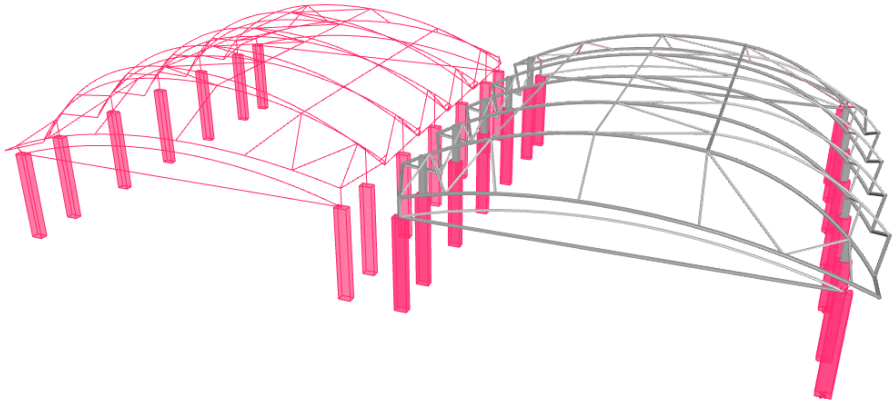

Figure 9: Engineering about geometric approach - dimensioning of pieces

For the membrane manufacturing stage it was defined to cover the entire area with 3 blankets, 2 of approximately 1500m2, a 200m2 central blanket and other vertical side enclosures.

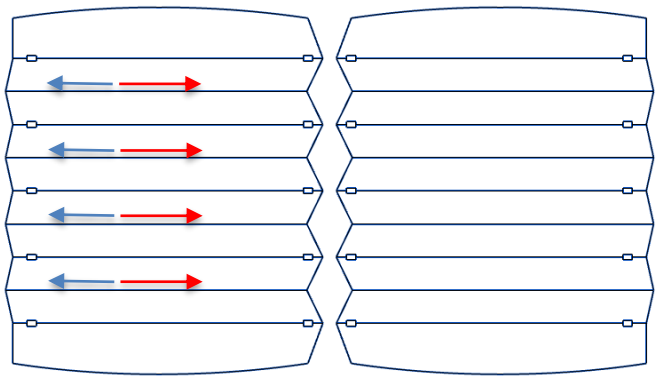

Figure 10: Main blankets of 1500 m2 c/u blue arrow and red arrow: different details

2. Fixation Details

The type of fixation of the membrane was considered according to the type of arrival at the edges, as well as the waterproofing at the edges and the opening points of the membrane to adjust the structure.

Figure 11,12,13,14: Fixation Details of membrane

2.1. Assembly process

The membranes come packaged very carefully from the factory, numbered and with a guide stuck on each corner that indicates the axis of location of each end. An assembly diagram is delivered in drawings where all the accessories and blankets are encoded, this is to have an efficient assembly process. A prior meeting with the installers and the person in charge at work is very important to clear up doubts.

For the assembly process, a membrane was first placed on the ground, which allowed protect it in the installation process and also to avoid damage with pieces that could tear the membrane. It was considered a pulley system that allowed to raise the membrane from the central tabs towards the arches more high after having fixed the entire perimeter.

For this membrane it was considered 4 cables with pressed terminals at the both ends for the fixation of the membrane, these cables are adjusted to have the other fixed edges. The membrane is raised with the cables already placed in their corresponding holsters.

In the central arches first the fixation is waterproofed by overlapping flaps that then are sealed in the place. In the perimeter of the coverage the flaps of that edge is fixed to a rectangular edge welded in the structure by means of a metal clamp that allows to create a kind of gutter of cloth that serves to orient the flow of water to the water evacuation points.

Figure 15,16,17: Membrane lifting process

The central and lateral zones are less complex, simply by means of metal elements and accessories the membrane is fixed at its high and low points, in the curved zone Fig.18, it was not necessary to put a cable in an edge holster, it was only considered in the manufacturing process make a thicker ends to define the curve of that ends well.

Figure 18,19,20: Installation of central module C and side module D

Finally there is another set of membranes to be placed between the columns of the extreme axes, these membranes are of another type of material where the perimeter fixation is basically with eyelet and halyard, having only a different detail. The upper end of these blankets is fixed by metal accessories to the main membranes solving the fixation without problems.

Figure 21,22: Installation of interior enclosures

3. Conclusions

Having a project that can apparently be solved at a general level, there will always be details that will define the final solution of a system for fixing a tensile structure. The dialogue between the specialties in this case architecture and engineering is very important to establish concrete solutions depending on the magnitude of the project.

The membrane details fulfill a special role for each case, which allows us to continue exploring different options of metal fixings, parts and accessories. The membrane with the sealing system has many benefits, which allows us to create prototypes at real scales by testing ideas we can have when developing a project.

For the assembly process, establishing a step-by-step installation process, coding parts and making a step diagram is important. For large projects, it is even more so since it can involve damaging a well-fabricated membrane. The climatic factor is also an important factor a blanket of more than 1200 m2 with the wind could be spoiled according to its lifting procedure.

References

[1] Arq. Roberto Santomauro (2008) “TENSILE STRUCTURES”. Montevideo – Uruguay.