The research and application of tensile membrane structures in the construction industry have been receiving increased attention. This is not surprising, as tensile membrane structures offer efficient and innovative solutions for covering large areas, while they function as lightweight, durable, and impressive structures. This raises the question of whether these solutions can be very well optimized for different goals.

The main aim of the thesis was to develop a design module that enables parametric pre-design, form-finding and geometric optimization of barrel vault tensile membrane structures, in one environment. This was a complex task, we needed to include some innovative ideas to make it possible.

In the first segment, we've done a detailed overview about tarpaulin structures and different kind of steel optimization techniques. Then, a strategy was made for reaching the goals of the diploma work. Secondly, the parametric membrane form-finding was established. Two different form-finding method was introduced, examined and used for defining shapes. We've made observations about mesh resolutions, behaviours and different technical issues. Conclusions were made about how these methods can be used for every day design purpose.

We've programmed a parametric FE model, with what we could do analysis and automatic design of cross-sections. To check the model's results, a second, more complex reference model was created in Dubal RFEM. This model is able to perform nonlinear analysis on the membrane and the steel, which was mandatory to define some conditions of the design later on.

Lastly, the steel structure was geometrically optimized for the self-weight, the number of connections and the covered area. We discussed the choice of objective functions, design conditions. 2 different tools were used on two different theoretical bases. After all the simulations, we've analysed the solutions in many aspects like element number, constructability etc.

As a result of this thesis, after specifying arbitrary input parameters, an umbrella-shaped structure is automatically obtained, along with determining the shape of the membrane. Using the interpreted workflow, other structures can be solved similarly.

At the end of the research, I made the visual source code available.