

Membranes for Bad Fischau

A Master's Thesis submitted for the degree of
“Master of Engineering”

supervised by
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Vienna, 15.10.2012

Affidavit

I, **ARCH. DIPL. ING. CLAIRE AIMÉE BRAUN**, hereby declare

1. that I am the sole author of the present Master's Thesis, "MEMBRANES FOR BAD FISCHAU", 72 pages, bound, and that I have not used any source or tool other than those referenced or any other illicit aid or tool, and
2. that I have not prior to this date submitted this Master's Thesis as an examination paper in any form in Austria or abroad.

Vienna, 15.10.2012

Signature

Preface:

At one point, sooner or later, every architect ends up asking the same question: „How are we going to build?“

Dealing with historical structures always requires acting in particularly sensitive ways. Can membrane structures, in combination with a historical monument, form an aesthetic symbiosis? Will the final appearance in the end be more interesting than its single elements?

I am going to try.

Claire Braun, October 2012

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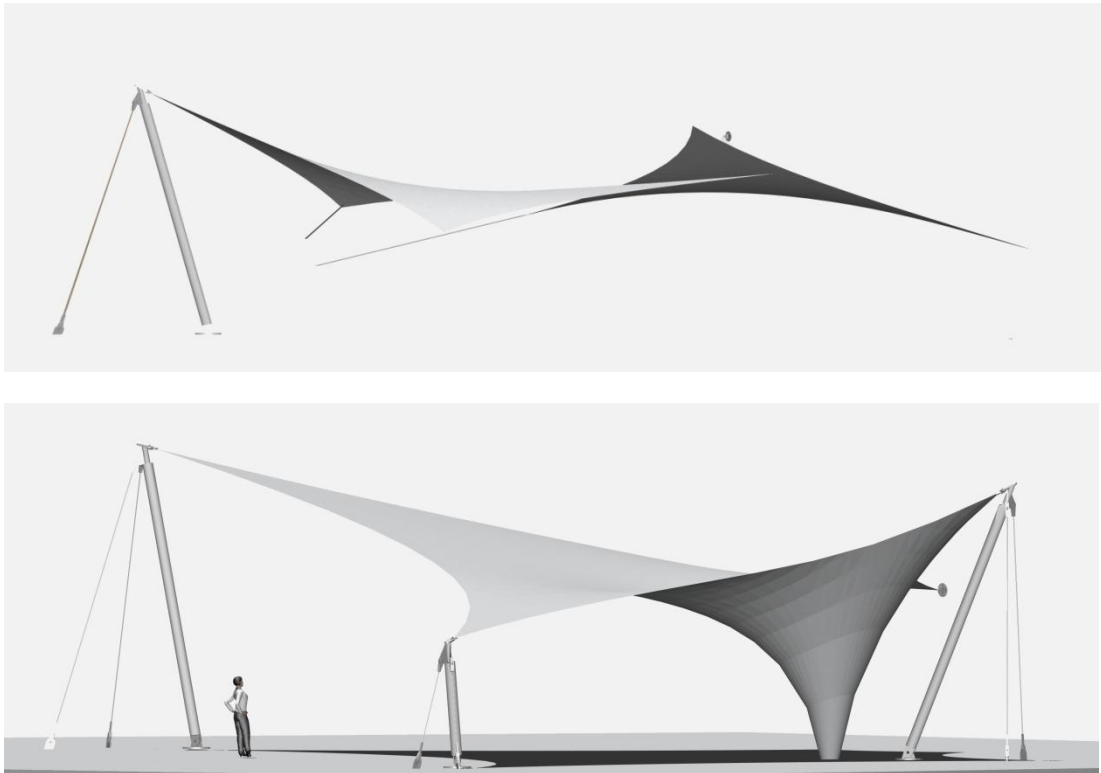
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Abstract

The membrane constructions for the existing spa in Bad Fischau should be the attempt to complement original building fabric with new forms and materials and to improve the usability of the bath through constructions serving the purpose of weather protection.

First and foremost, it seemed important to me to install architectural forms that are appropriate for the site – a spot where nature with its hot springs and water basins holds energy in abundance. Second, I was trying to find suitable architectural solutions for the existing historical buildings.

Both requirements can be fulfilled with membrane constructions. I do justice to the site by using the form of membranes as the sails in front of the restaurant model the fluctuating waves in the water with the funnel construction in front of the café representing the springs.



The final question which forms I am supposed or allowed to add to the existing buildings in the end proves superfluous as the form of a membrane, out of necessity, results from the construction.

1 Basic Information

1.1 Introduction: Why did I choose this topic?

For my master's thesis I decided to choose a real-life construction project where I can apply membrane constructions. It is my objective to put into practice a conceptual design and to find the answer to the following question: In what way should we set about building constructions in a historic site, using contemporary and up-to-date architecture without chumming up too much yet respectfully keeping the building stock instead of interfering or dominating too much.

The result should be a combination of historic and contemporary architecture which is more interesting and more attractive than the respective parts from times past and present. The attractiveness of the design should indeed be used for marketing purposes as the site ought to be revitalized.

When looking for an appropriate task I was contacted by a friend who was looking for a sunshade construction in the restaurant and entrance area of a water park. I knew the water park (I love it for its architectural ensemble) and that is how I came to Bad Fischau.

When I saw the water park for the first time I was impressed by the power of fountains in the historical ambience. To me, building a light membrane structure seemed a perfect addition to the wonderful old structure. Yet, not only the comparison between old and new architectural shapes and structures (heave and solid versus light and transparent) but also the juxtaposition of building types of high and low energy use at a place where nature seems to waste energy fascinated me.

Architecture in the context of historic structures for me represents a thrilling and challenging task. What form and what material is adequate next to the existing ones, i.e. turn-of-the century brick-buildings and timber constructions from the 1930s?

And how can I express the energy content of this site?

Will architecture evolve? Will we merely repeat, every now and then, our language of shape? Can we, by way of combination and addition of different shapes, create new forms?

What will be the answer of contemporary architecture to the architects of 1900 and 1930 at this dynamic site?



Fig. 1

1.2 Site

The water park is situated in Eastern Austria, 55 kilometers south of Vienna, along the northern line of the hot springs of Baden, Bad Fischau and Bad Fischau-Brunn.

Address:

Thermalbad Bad Fischau
A-2721 Bad Fischau- Brunn
Hauptstraße 10

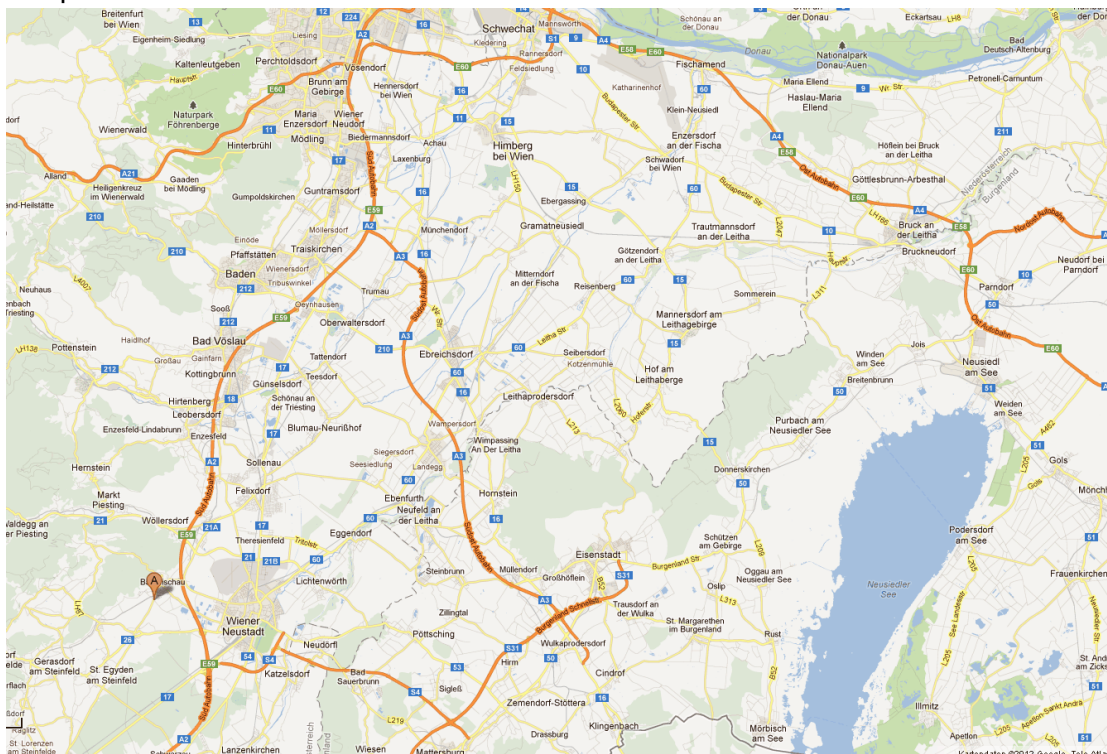


Fig.2



Fig. 3

1.3 History

Overview

- 1363 First mention as a bath
- 1872 A basin was built by Franz Plitsch
- 1898 Erzherzog Rainer buys the area for 55.000 guilders
- 1900 Opening of the Thermalbad after renovation and design of the park
- 1928 Enlargement of the men's basin
 - Establishment of new sundecks and sunbaths
 - Renovation of the ladies' pool
- 1992 The complex is put under preservation order
- 1993 End of the ownership by the Habsburg family
 - Municipality of Bad Fischau- Brunn acquires the whole complex
- 1997 Establishment of the "Freunde des Bad Fischauer Bads"
- 2010 D.I. Thomas Zellinger starts the new area as leaseholder

Thermenregion: Baden, Bad Vöslau und Bad- Fischau- Brunn

"Alongside Baden, at the border of the northern hot springs line, another two hot springs resorts from the early 20th century that thanks to their historical charme were time and again used as movie set, have been preserved: Bad Vöslau and Bad Fischau," writes Iris Meder in her book "Badefreuden", ¹

"1816 sees the first construction of a bath house in Bad Vöslau, in 1868, following the boom of Bad Vöslau and due to competition with the town of Baden, a comprehensive extension of the spa became necessary, an extension supervised until 1873 by the architect of the Vienna Ringstrasse, Theophil von Hansen," Meder goes on in her book.²

In 1872, Franz Plitsch builds a basin with a holding capacity of 900 m³ of water.

¹ Meder, 2011,110

² Meder, 2011, 110

In 1898 Archduke Rainer purchases the spa as well as contiguous lots and has it extensively renovated in the following year. Two basins, a men's basin and a rotund ladies' basin are constructed, a double row of wooden cabins is added to the basins. The blueprints for the spa complex came from the Archduke himself, the construction was supervised by the Imperial Royal Builder Gerl from Vienna. The landscape park was implemented by the Spa's superintendent Theodor Wichmann and Court Gardener Franz Jirsa from Hernstein.

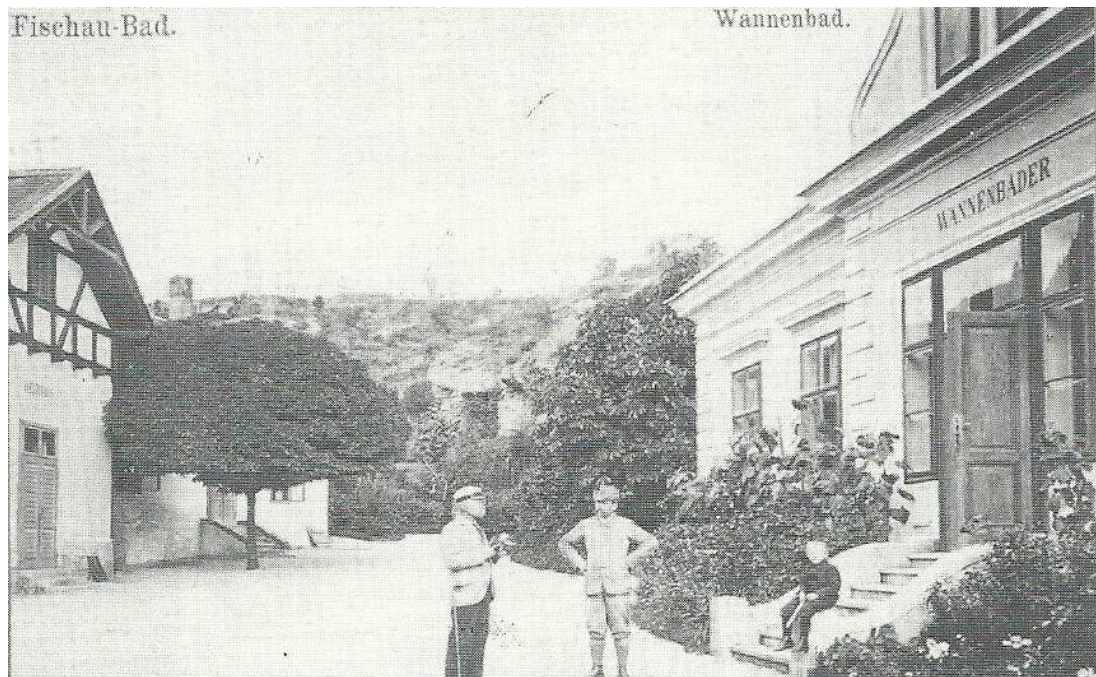


Fig. 4

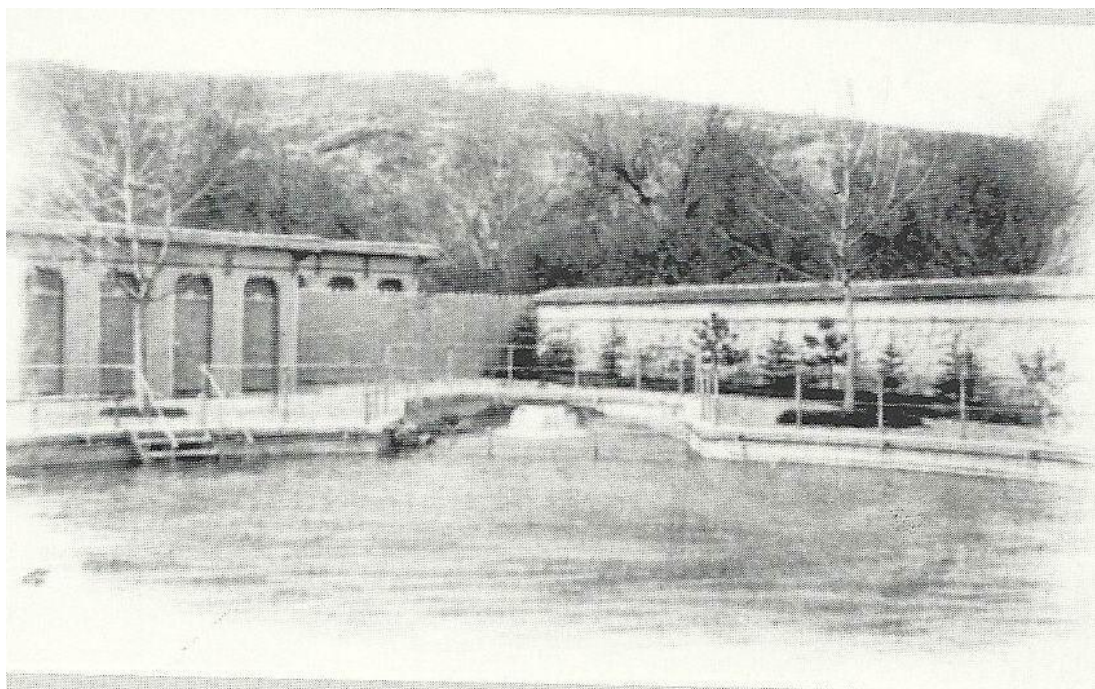


Fig. 5

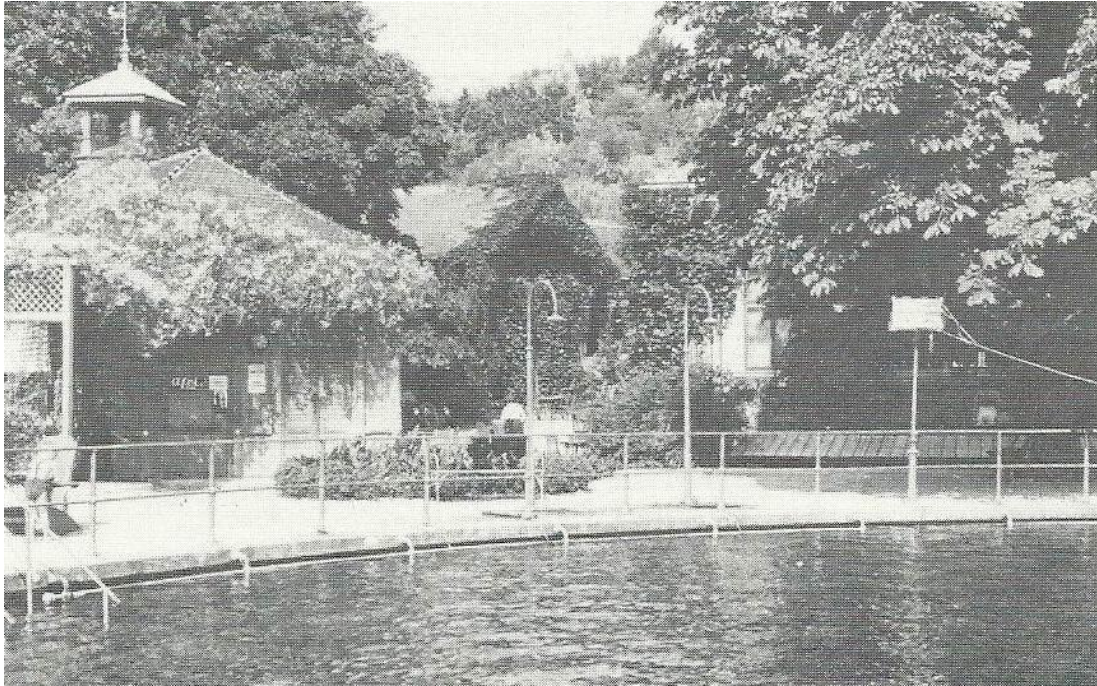


Fig. 6

1928 sees yet another extension with the enlargement of the men's pool and a new construction of the sundecks and sunbaths. The ladies' pool is renovated and the cabin rows extended. The works are supervised by Town Master Mason Kainzl.

During the last days of World War II the main building and the spa entrance area, originally located next to the watering place in the Badgasse) are destroyed in a fire.

The following decades saw no investment in the preservation of the building fabric and the complex more and more fell into disrepair.

From 1985 onwards the spa was leased to the municipality and in 1993 the latter purchased the spa complex.

By notification from 13 September 1991 the entire spa complex was put under preservation order (the notification was modified on 16 November 1992).

Towards the end of the 1990s the association "Friends of Spa Bad Fischau" [Freunde des Bad Fischauer Bads] was created. In 2010 D.I. (M. Eng.) Thomas Zellinger became tenant, intending to revitalize the spa into an attractive resort for insiders. The complex saw the addition of a sauna and the spa could be used all year long. Currently, the spa offers a varied programme, including concerts, trick fountains, "Dirndl Springen" and a traditional New Years Congregation (in the water!).



Fig.7

1.4 Currant situation:

1.4.1 Ownership:

The bath is owned by the municipality of Bad Fischau that rents it out to different persons. The current leaseholder is trying to increase the cultural and economic potential of the real estate after a period of dilapidation.

1.4.2 Hot springs:

Three fountains exist, bubbling out water (of drinking quality) at a constant temperature of 19°C. One fountain is filling up the men's basin, which holds 10,000.000 liters. The spring with its delivery flow of 40,000.000 liters fills the basin four times a day. People (and fish) swim in drinking water. No chemical additives are necessary.

The spring water helps patients suffering from skin diseases, varicose vein and stress.

1.4.3 Activity offers

As the water comes out at a constant temperature of 19°C, the bath is in use in both summer and winter. The following facilities are available:

- The hot mineral springs
- Three pools, made of stones, clay and gravel (no need for foils)
- Sauna
- Restaurant and coffeeshop
- Beach volleyball court
- Regular events such as
 - Concerts
 - Trick fountains with light shows
 - Sport tournaments
 - "Klangbad" (young bands performing live during the day)
 - New Years Celebrations ("Dirndlspringen")



Fig. 8

1.5 Requirements for the new structure

From a client's point of view:

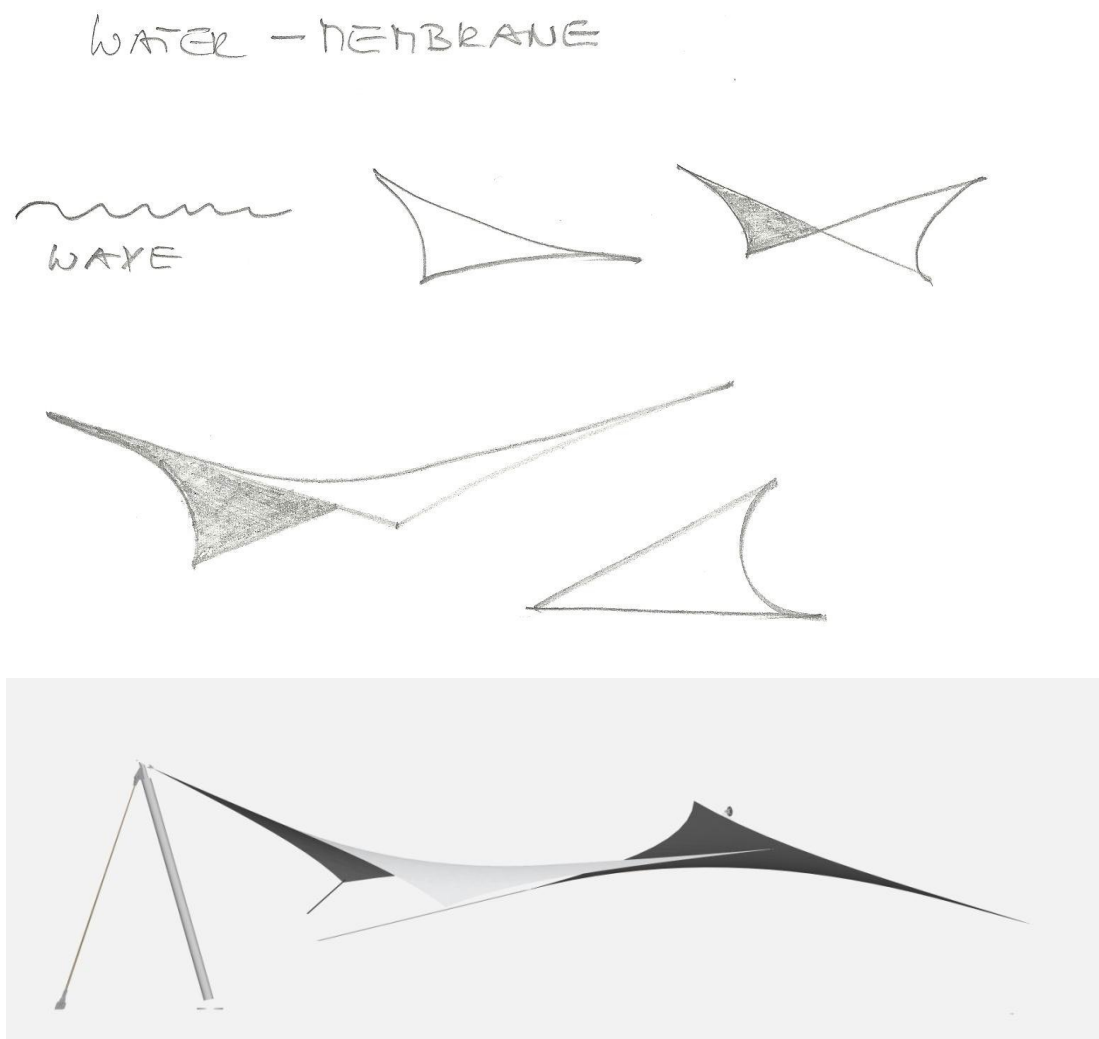
- A weather shelter structure is needed against rain and sun for the restaurant, the café and for events like the concerts, trick fountains show, sport competitions etc. ... However, the structure should not permanently roof the entire area as in spring and autumn people like to sit out in the sun.
- The construction should be appropriate for class listed monuments.
- The new structure should raise the attractiveness of the site.
- It should be aesthetical.
- It should be easy to handle (easy to move out and remove again).
- It must be economical.

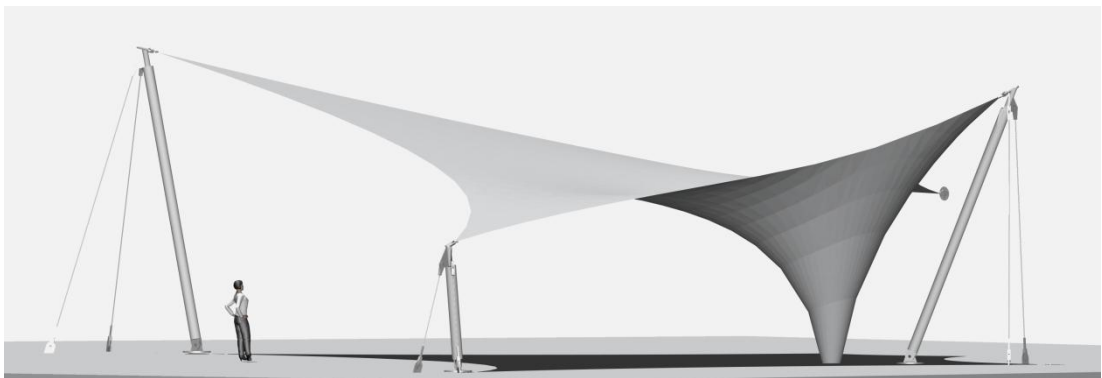
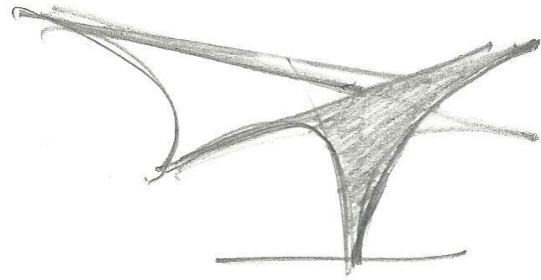
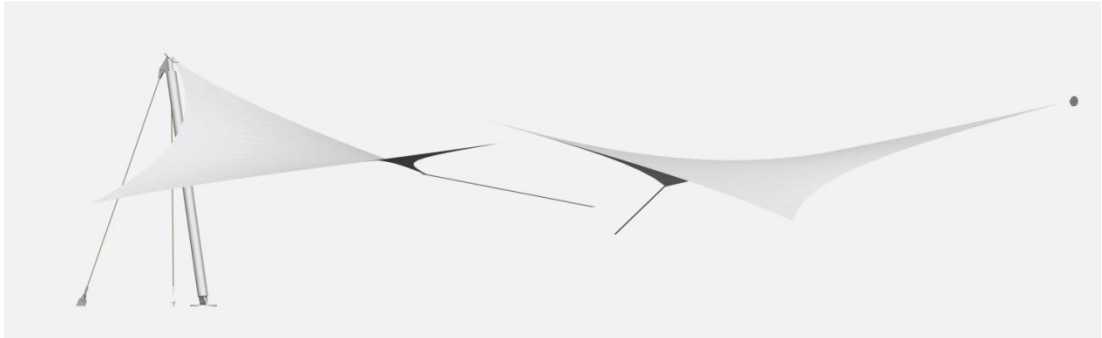
My personal view:

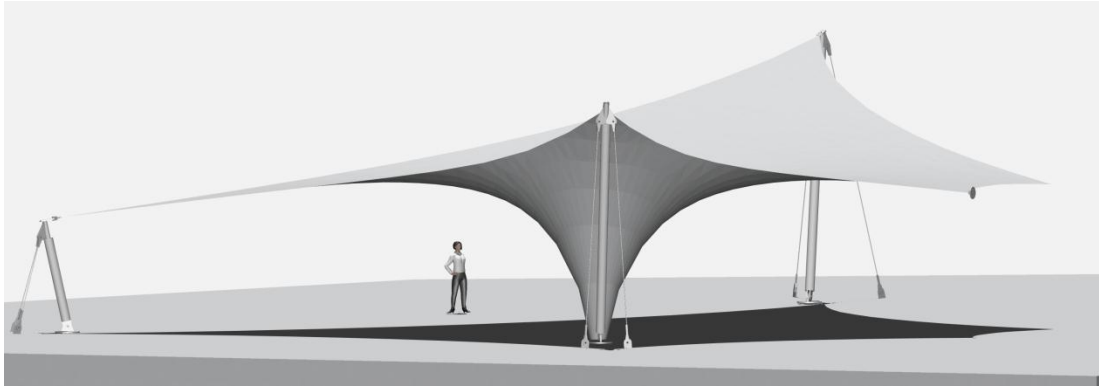
- The design should cater to all needs and wishes from the clients.
- It should also be a suitable addition to the historic complex and the park. The structure should create a dialogue between old and new designs, attract people through its shape and allow for even more applications.
- The view from the entrance to the main pool should be without any supports.
- The new structure should not be taller than the existing ones.

1.6 Why should it be a membrane structure?

The site is a place full of movement and energy, like the shapes of membranes. The flexible forms of waves and the dynamic shape of springs correspond with sails and funnels.







Why have I decided to choose this form in the context of historic buildings from 1900 and from 1930?

We can respond to the question how we are going to build using several theoretical approaches from constructing engineers and architects who offer their specific justifications for the approaches chosen:

„Eine Aufgabe mit minimalem Materialaufwand zu lösen, ist letztendlich das einzig interessante Problem“
Bernard Lafaille³

Solving a task with a minimum of materials is, in the end, the only problem of interest.

Bernard Lafaille

The approach adopted by Frei Otto was born out of the materials shortage that he had to face as the 20-year-old leader of the construction team in the prisoner-of-war camp in Chartres, France.

“Time and again he discovers that the need of materials is linked to the number of the tension members in the construction system and that, by heightening the tension and by concentrating the pressure on a minimum of short supports, such as using lattice girder elements resembling the shape of a fishbelly, it is possible to reduce the need of materials to an absolute minimum.”⁴

With Frei Otto as well as with Antonio Gaudi the architectural form is born out of the construction process as both work with mobile polygon models, thus equating the architectural form with the construction.

Frei Otto on aesthetics: *“Developing hanging constructions and particularly “taut skin constructions” it was fascinating to observe that by looking for various forms of construction with a mere minimum of building material you could watch architectural forms of absolute clarity and impressive beauty arising from it. These were forms*

³ Drew, 1976 ,6

⁴ Drew, 1976, 8

*that could never have been designed but that ought to be seen as resulting from the task that had been set.*⁵

In the meantime, the proportion of material costs and labor costs has been reversed, today material is rather cheap and labor force expensive. Rather than cutting down the need of materials we usually ask for a minimum of energy that is put into the construction of a building. What is meant here is the total energy balance, i.e. the effort used for producing the materials, transportation costs, assembling costs, the energy costs when running the building as well as waste disposal costs.

Questions about the style of a membrane construction do not arise as the architectural appearance results from the construction project and the general form. This is why such a construction for me seems to be an ideal form for an extension of existing sites.

I have decided to choose the membrane construction for Bad Fischau as

- the flexible forms of waves and the dynamic shape of springs correspond with sails and funnels.
- its form results from the task set
- economic efficiency is of timeless quality
- the construction is sustainable
- there are neither thermic nor acoustic requirements
- the diffusion of the internal as well as the external space is dissolved
- the canvas create an atmosphere of leisure and ease

⁵ Frei Otto und Peter Stromeyer: Zelte

2 Fundamentals:

2.1 Examples:

I decided to choose a rather personal approach when putting together some examples of constructions that might inspire me. I was looking for membranes in the context of water, swimming pools and water parks applied, in addition to that, on historical buildings. Size or form requirements did not represent a selection criterion, I have picked out those that seemed fascinating to me. One of the most exceptional examples is the “Berlin Badeschiff”.

2.1.1 Berlin Badeschiff an der Spre!

http://arena-berlin.de/badeschiff_winter_2011-2012.aspx

The “Badeschiff”, afloat on the Spree river is a “Schubleichter” *that was rebuilt* and that, in summer time, can be reached via an ample wooden balk. It has been designed by Susanne Lorenz and the Spanish group AMP Arquitectos together with Gil Wilk.

In 2005, the first year after its opening, the building was expanded for use in winter time. Arches made of pine wood form the structure above which had been strapped a double-walled PVC membrane. (Architects: Gil Wilk Architekten together with Thomas Freiwald).



Fig. 9

In spring time the membrane gets deinstalled and the basin changes back into an outdoor pool again.

This construction is neither a self-supporting structure nor form active. The shape is pre-given by the wood construction.



Fig. 10



Fig.11

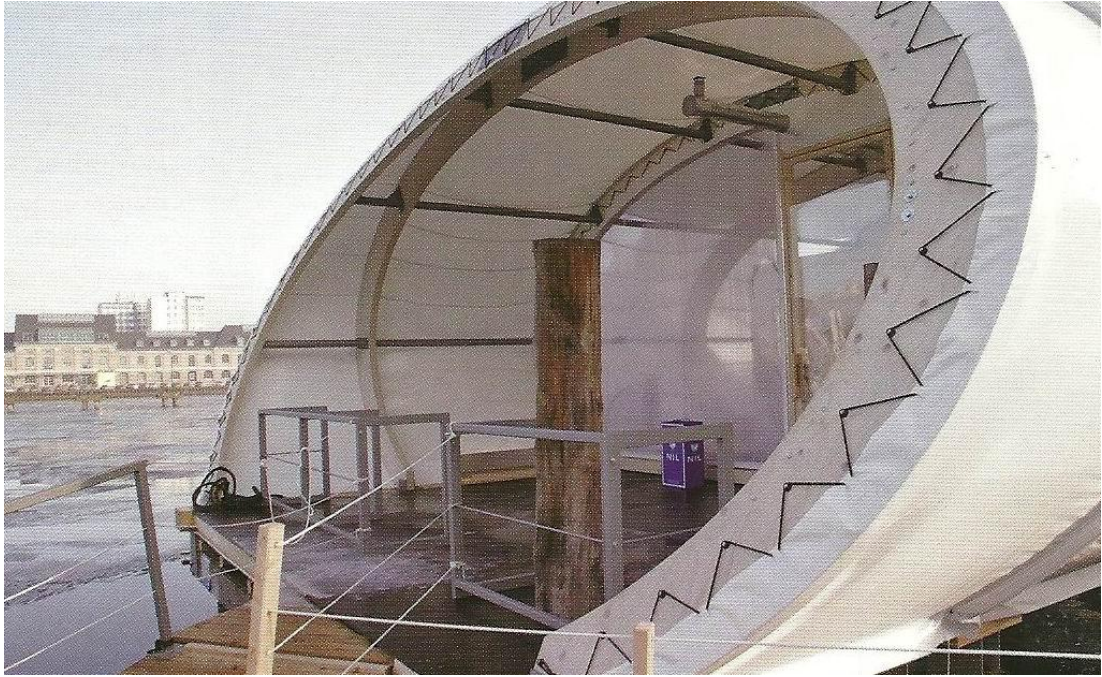


Fig. 12

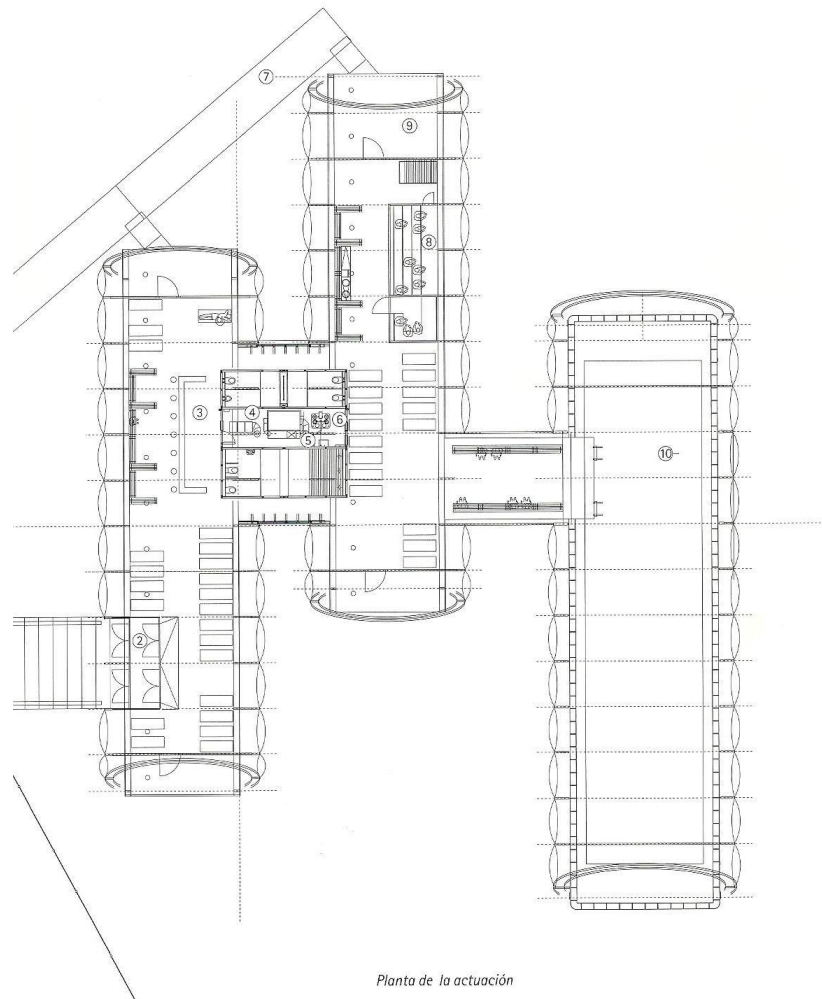


Fig. 13

2.1.2 Old Spinnery Kolbermoor, Germany



Fig 14

Text and pictures: <http://www.competitionline.com/de/projekte/48600>

“The membrane roof in front of the power house, designed by the Munich architect’s office Behnisch Architekten, has a surface of about 1,200 square meters. It spans an area of about 200 square meters and is made up of the closed membrane surface and a belt net of about 965 square meters statically connected with the membrane, thus forming its structure. Both components consist of the same, high-strength material, a PTFE fiberglass cloth. Stainless-steel cables are forming the load-absorbing enclosing rim of the membrane and the belt net. The pre-spanned belts have a width of 10 centimeters and a length of 40 meters.

With the help of pin-jointed stainless-steel belt knots that are hinged at the bordering cords, the belts form an irregular three-dimensional net structure. Wooden pylons of glue-laminated larch timber support the membrane construction. The pylon heads are anchored on the rear on four sides using stainless-steel cables. Aligned in that way, the pylons get spatially defined and secured. The anchoring as well as the bordering cords have been anchored back in fundaments. In addition, ropes have been affixed onto the bordering cords as a sort of trellis for climbing plants. The membrane construction, statically and structurally connected with the belt net, represents a novel and, as concerns planning and technical aspects, a considerable challenge that has been solved by Seele together with architects and structural engineers”.



Fig. 15

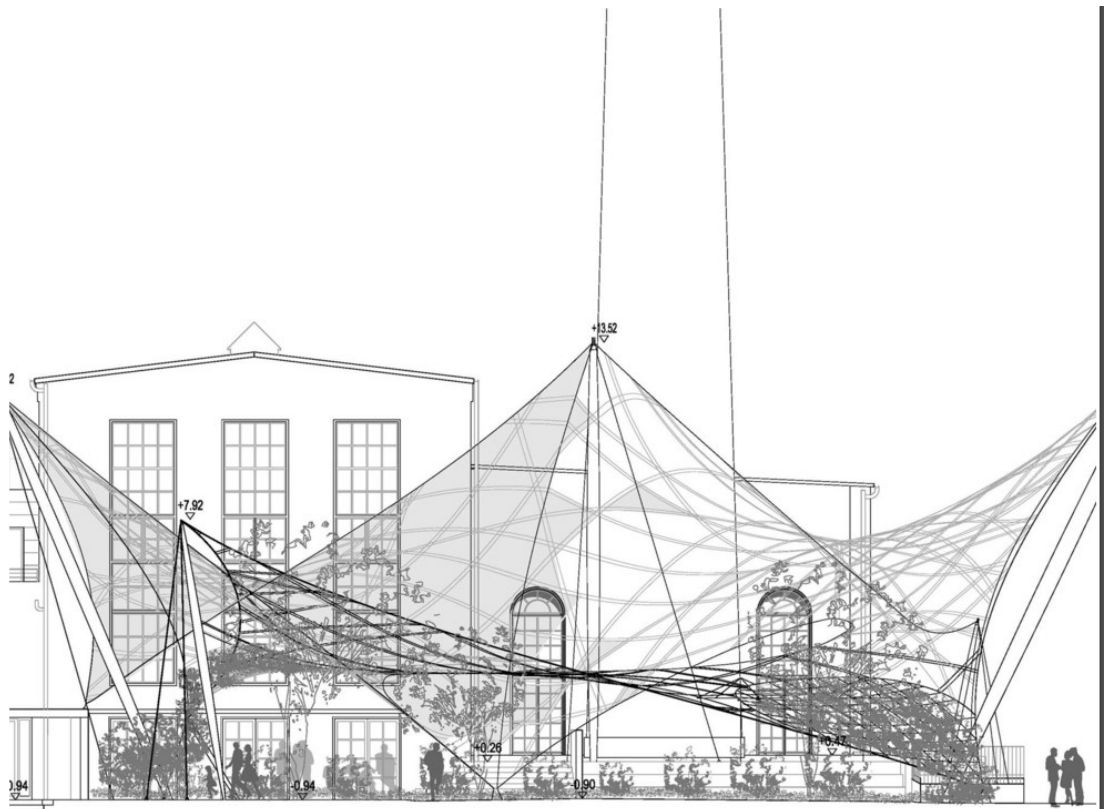


Fig. 16

2.1.3 Treffurt/ Deutschland, Gemeinde Treffurt, Burg Normannstein
Kiefer. Textile Architektur Architekten und Ingenieure



Fig. 17

2.1.4 Valetta/ Malta, Ministerium für Tourismus Malta, Mnajdra/ Tempelanlage
Weltkulturerbe; Kiefer. Textile Architektur Architekten und Ingenieure



Fig. 18

2.1.5 Convertible roof for the fort at Kufstein, Austria

Kugel + Rein, Architekten und Ingenieure

http://www.kugel-rein.eu/content/projekt_001_box/001_imgbox_planung.php

All pictures: http://www.kugel-rein.eu/download/KUGEL+REIN_Kufstein.pdf



Fig. 19



Fig. 20

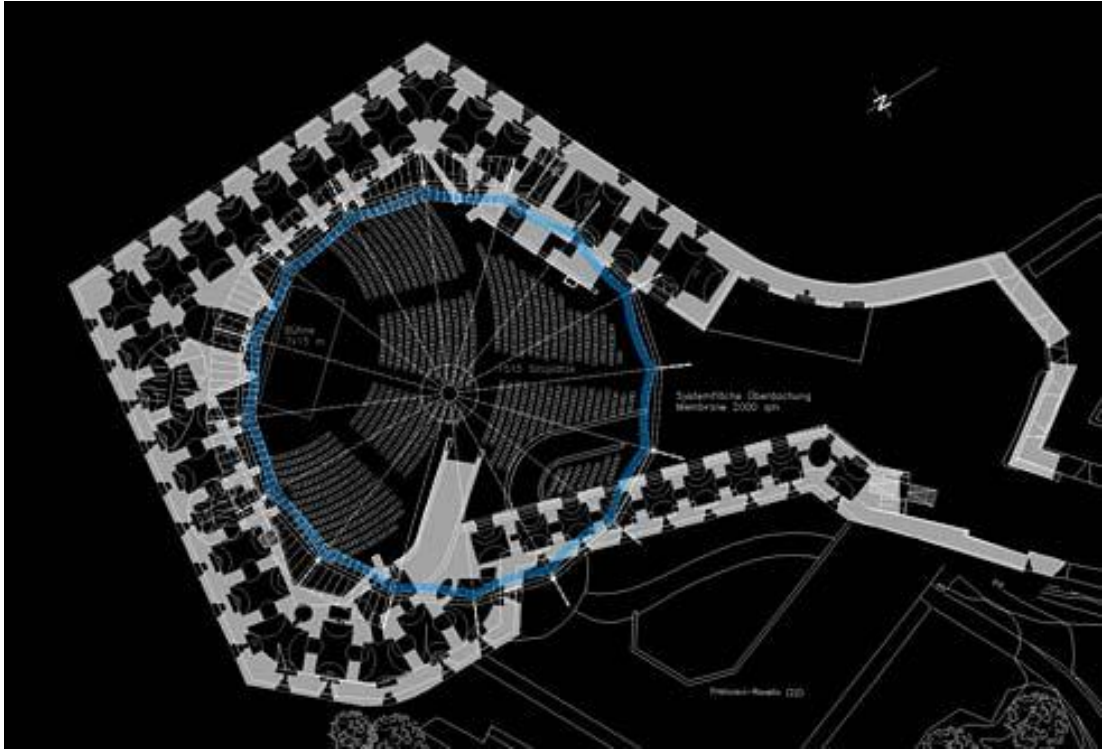


Fig.21

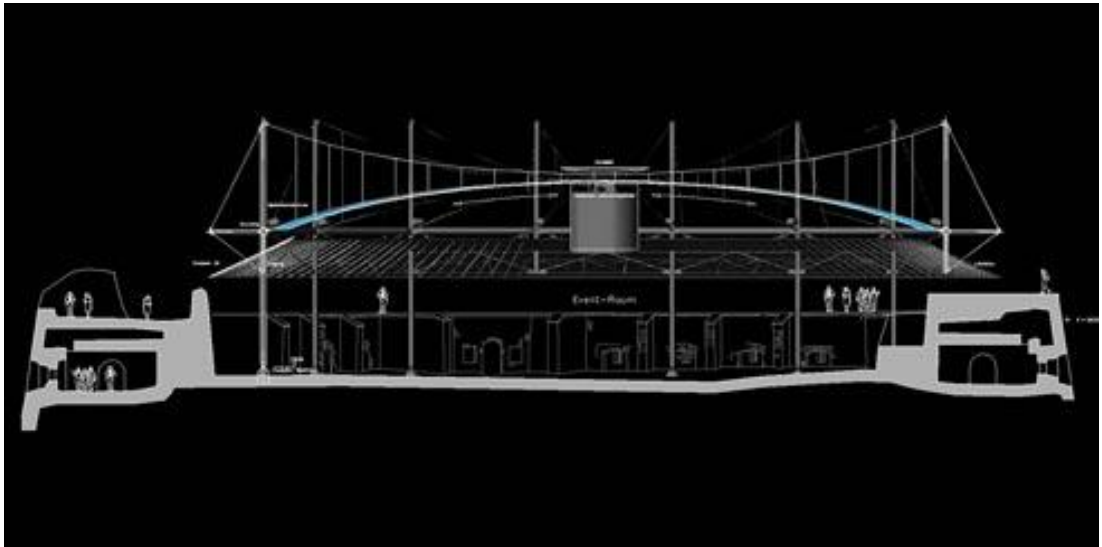


Fig.22

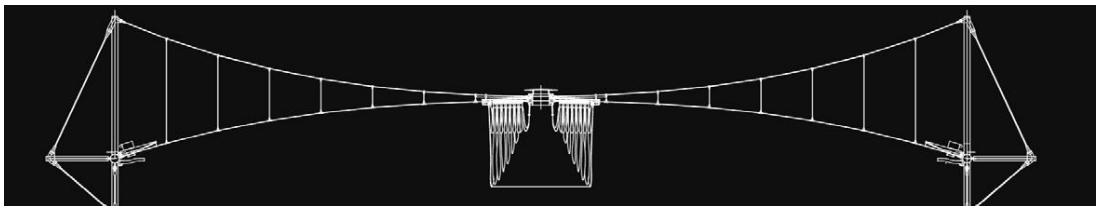


Fig. 23



Fig. 24

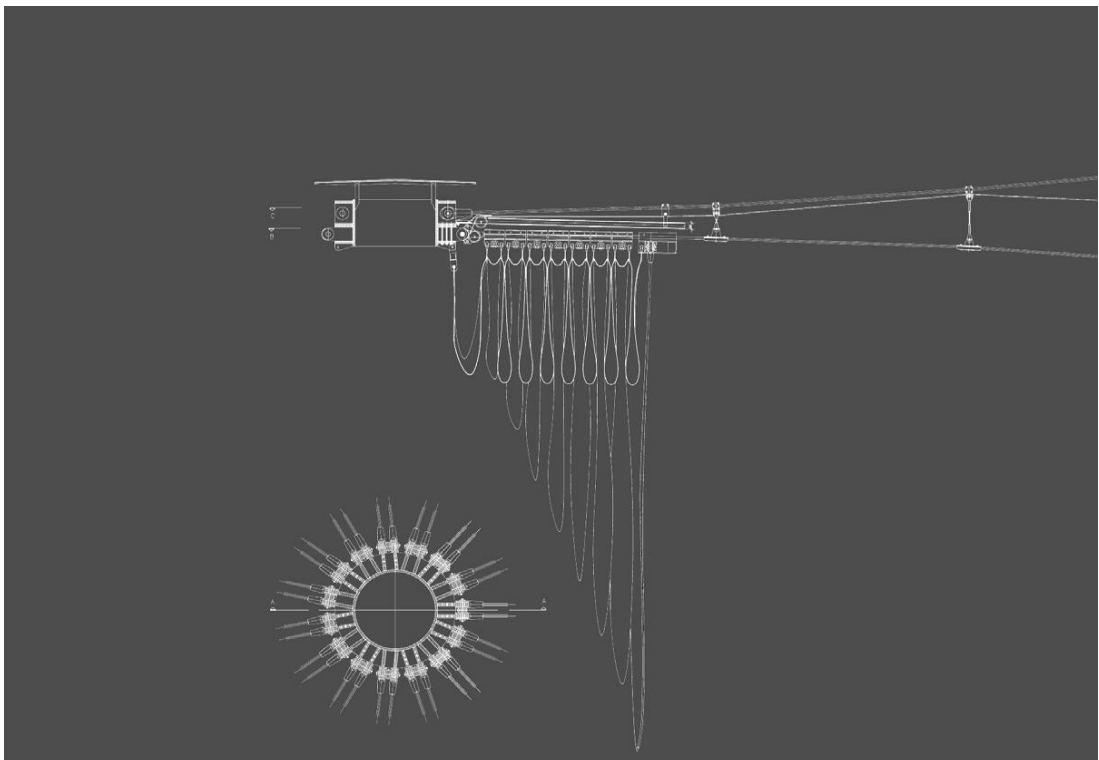


Fig. 25

2.1.6 Erlebnisbad Ergolding

4 Point-Sail about 70m², covering a children's playground in Ergolding
<http://www.aeronautech.de/objektaussen/membranbau.htm>



Fig. 26

2.1.7 Langnese Summer Club, Spain

17 sails arrangement for a Club in Spain, flat sails, can be used only temporary



Fig. 27

2.1.8 Kongressissimo Tagungshotel

Canopy for a restaurant with 4 sails

<http://www.aeronautech.de/objektaussen/membranbau.htm>



Fig. 28

3- point sails, plain, without curvature: it must be a covered area,
The sails look attractive, but it is not a form-active structure.

2.1.9 Footbridge in Val Joly

<http://www.arcora.fr/references/valjoly/valjoly.php>



Fig.29

Architect: Michel MAROT, Structural Ingenieur: ARCORA ingénierie structures

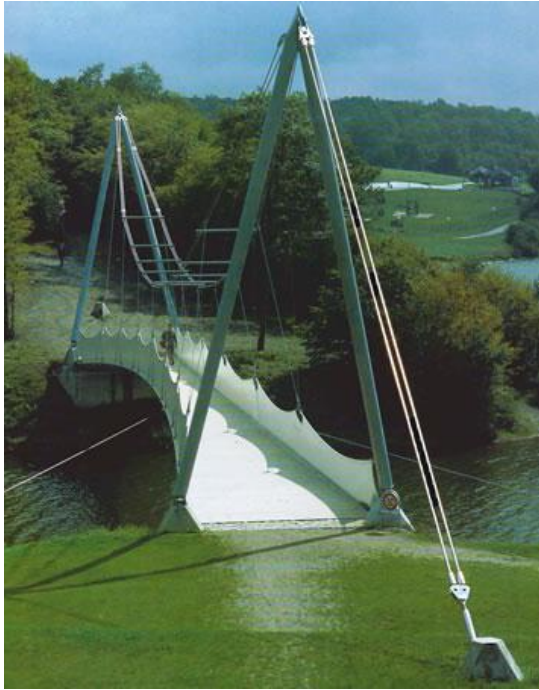


Fig.30



Fig. 31

2.1.10 Conopy over setting basins Valenton

<http://www.arcora.fr/references/valenton/valenton.php>



Fig. 32

Architekt: Adrien Fainsilber, ARCORA bureau d'études d'exécution des membranes textiles. Realised in 2002

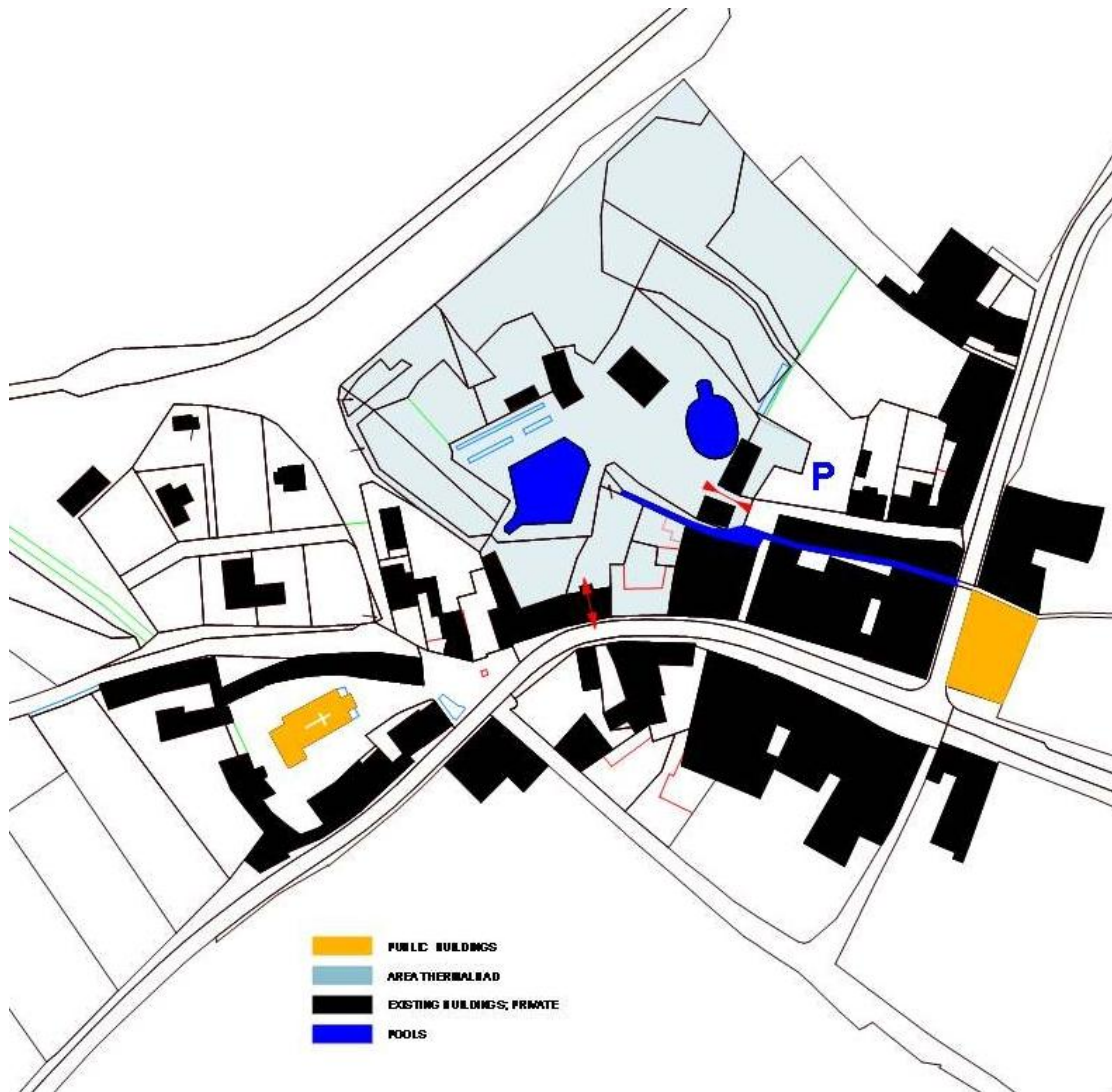
3. Design basics:

3.1 Urban situation in Bad Fischau.

The spa is located in the district of Wiener Neustift –Land, west of the town of Bad Fischau, along the main road between church and municipal office. The entrance area in the south is for pedestrians (Hauptstrasse 10), the parking area is located in the east (entrance Badgasse).

The area along the main road resembles a street village with closed rows of buildings. Next to the entrance area of the spa there are, however, two gaps in that row.

All photographs and drawings have been produced by Claire Braun





Beside the entrance building are gaps in the building line.





3.2 Analysis of the site

The entire complex with its buildings, basins, cabins as well as the outdoor design has preserved its shape of 1899 and 1928. It had been owned by the Habsburg family until the end of the 20th century. Today, the spa is a class listed monument.

The main entrance is situated, other than before, in Badgasse 10. Cash desk, the sauna entrance to the left and the café are located in this area. From there, visitors have a good view on the main pool (the men's pool in former days) and the main



cabin complex. To the right of the entrance is a ball game place and, further down, a small children's pool in the middle of plantings and a sandbox. Following the path, visitors go past the restaurant and the rotund pool, the former ladies' pool.



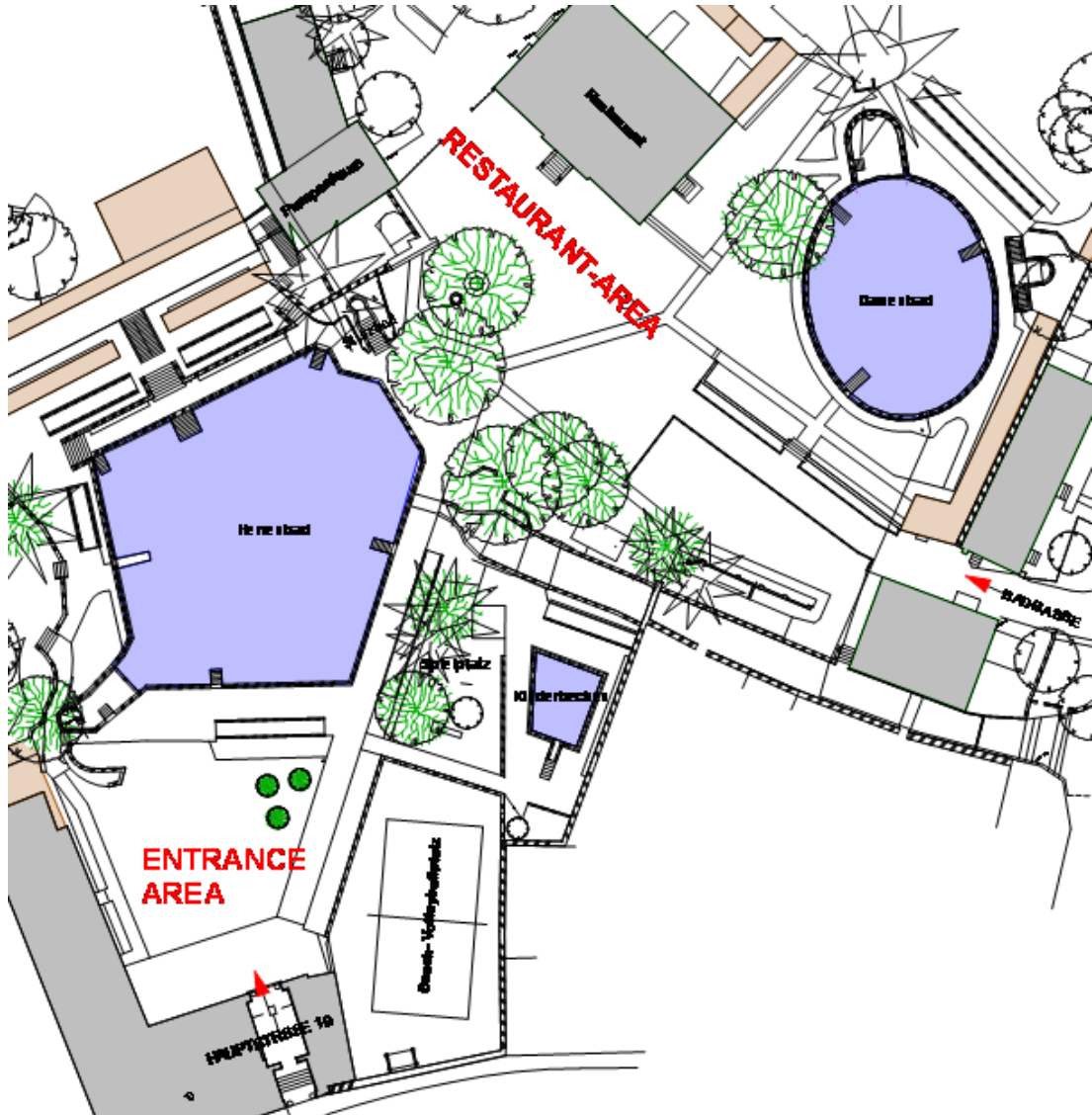




Plank beds have been arranged around the pools. The entire spa complex, with its *old tree population, hedges and flower beds leaves the impression of a well-maintained, park-like area*. Cabins are scattered over the entire complex, behind the main pool, along the sunbathing lawn and next to the side entrance. Some visitors might also be attracted by the waterfall of the bath's grotto.

Café and restaurant form the main areas of social interaction and communication. It is here where events take place and where weather protection in the form of mobile roofing is needed.

4. Design studies



Site plan of the Thermalbad
Geometer: Vermessungskanzlei Prof. D.I. W. Guggenberger, 2560 Berndorf Stadt

4.1. Evolution of the design task

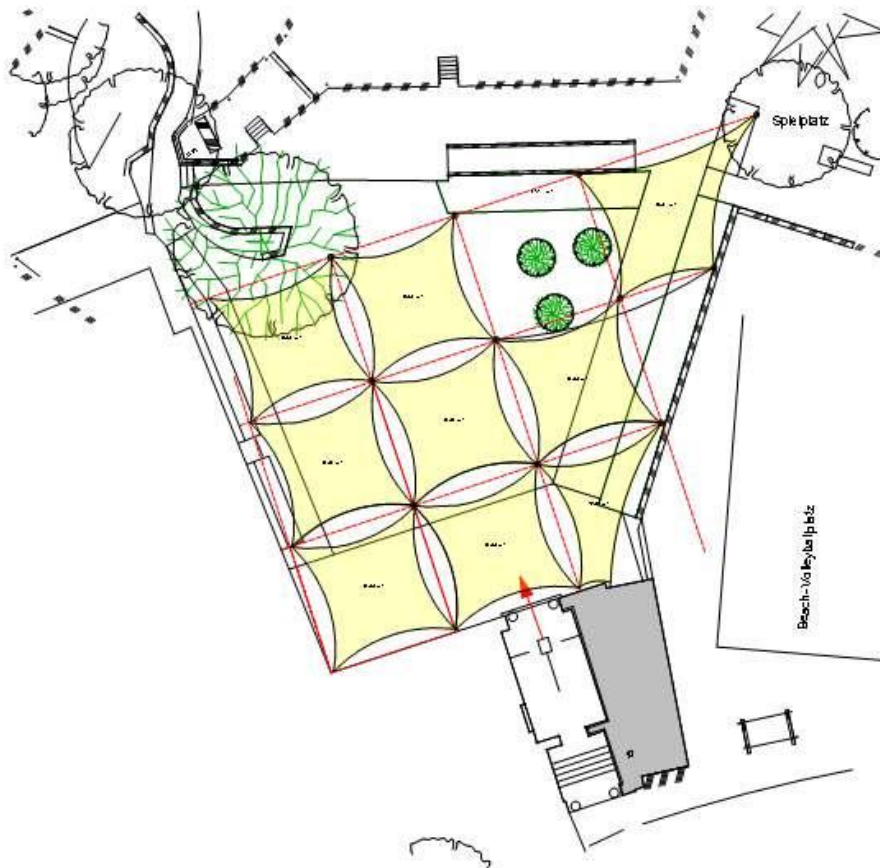
Urban landscape improvements – closing the gap in the row of buildings – cannot be implemented through the design task as the construction, due to its secluded location and the moderate size, has no effect upon the townscape.

To achieve improved usability of the spa complex we suggest transferring the event area for concerts and performances of all sorts in the extended entrance foyer and the café. The closed, L shaped building is better suited as venue for performances than the open restaurant area.

The entrance area for visitors of performances should be moved to its original location in Badgasse as the parking lots are there. Hence there would be no mixture of the streams of visitors and the visitors would not have to cross the stage area.

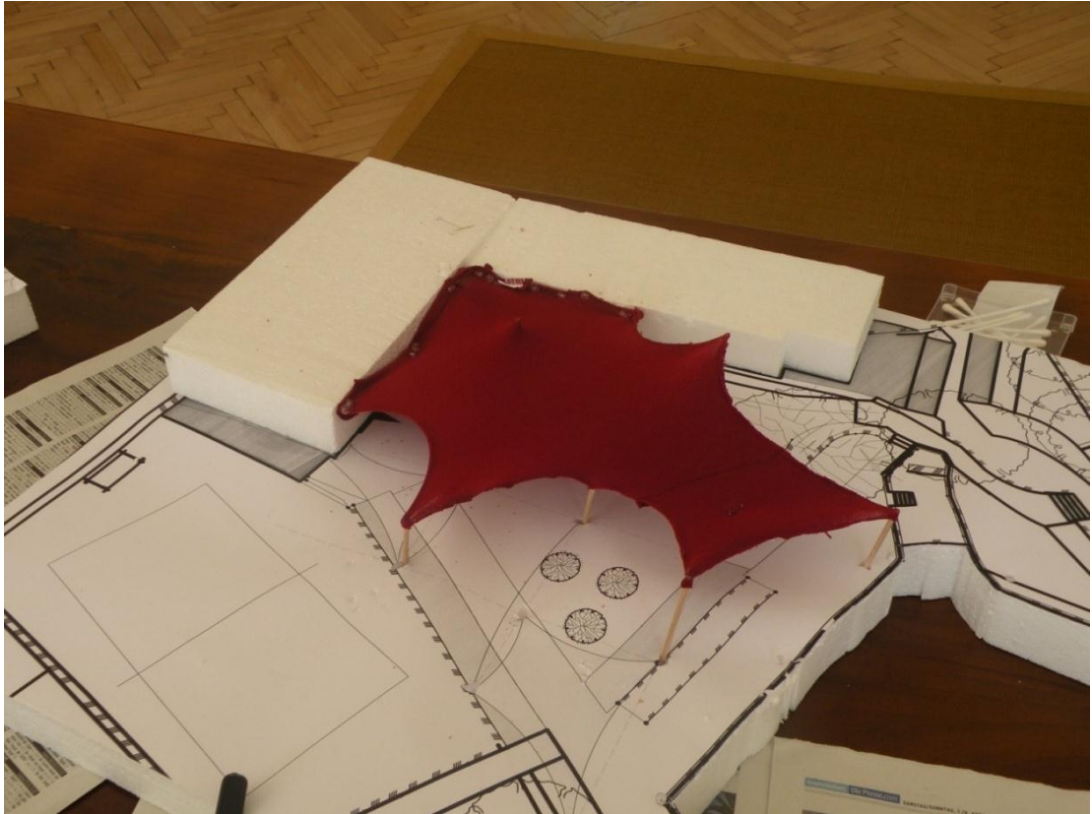
First steps:

Café, Entrance area: Following the easy manipulability of the canvas and the analogy with the cabin structure the first idea had been a small-scale structure in the café area.



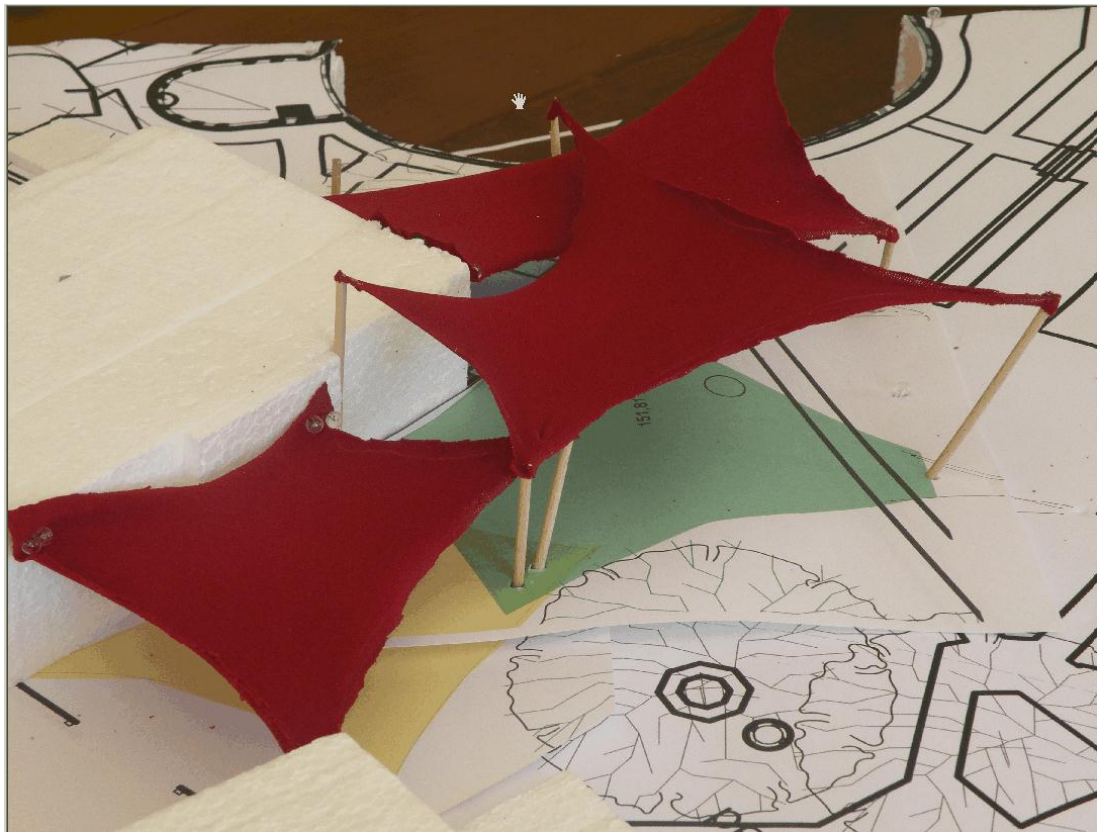
Arrangement of cabins

Due to the increased number of supports, this structure had soon been given up in favour of a larger roof structure.

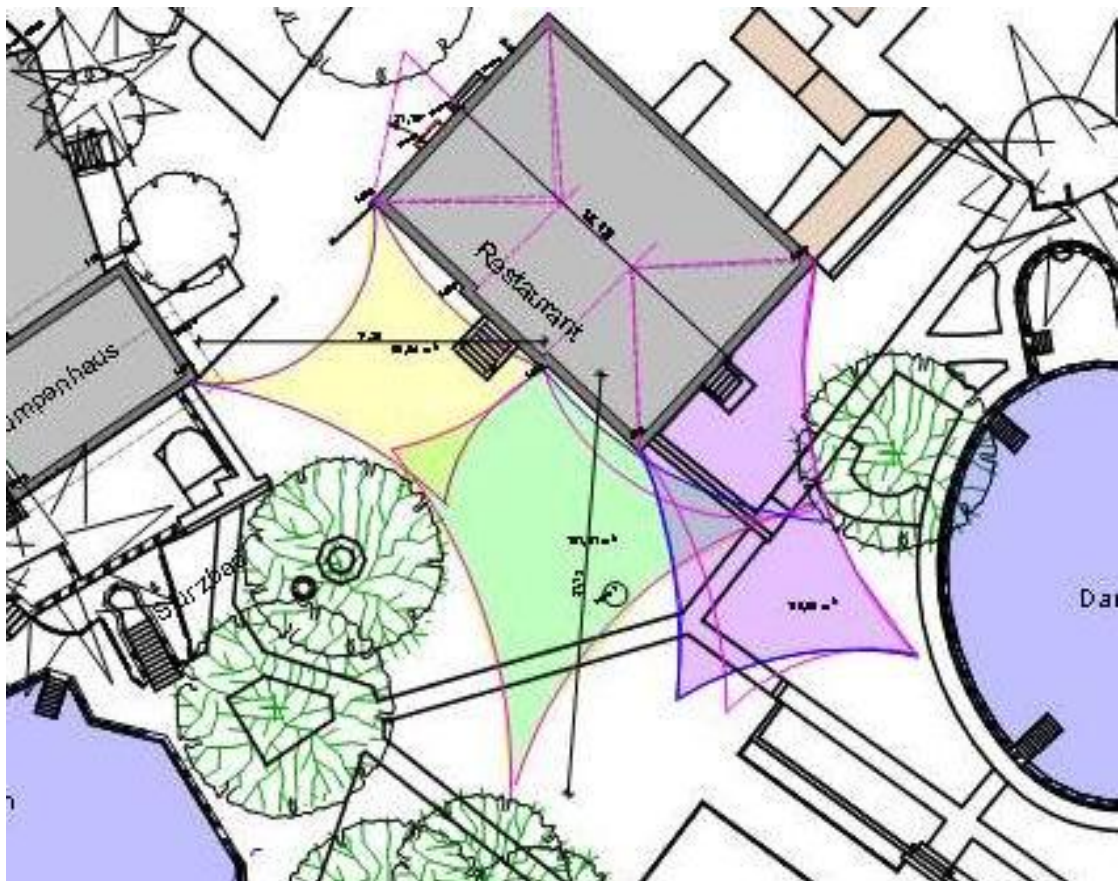


Entrance- area, model and floor plan

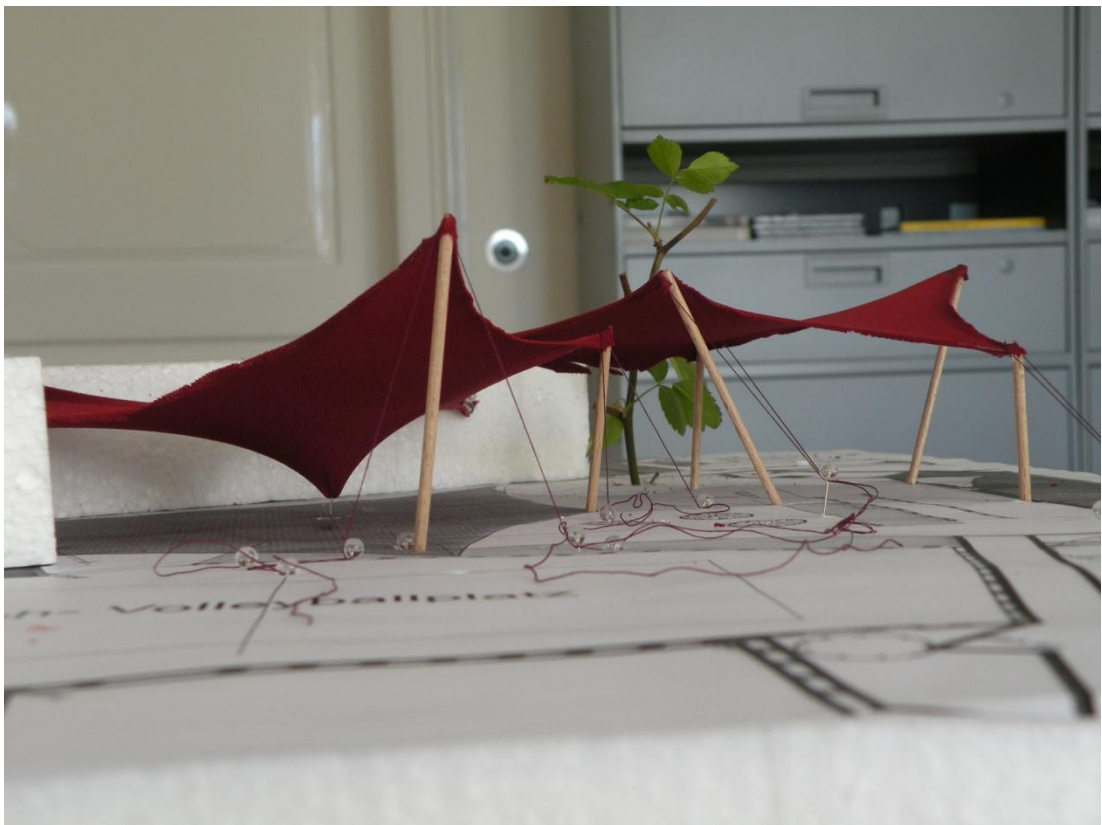




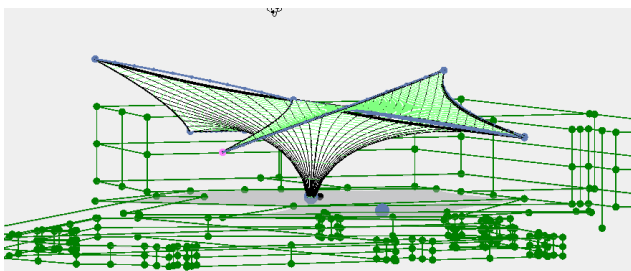
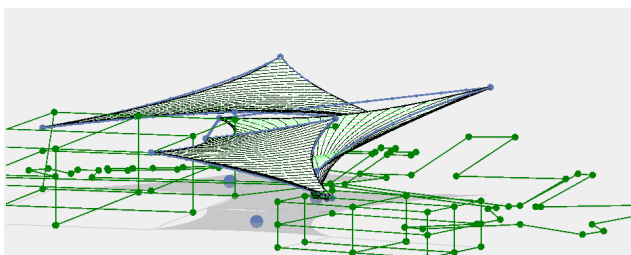
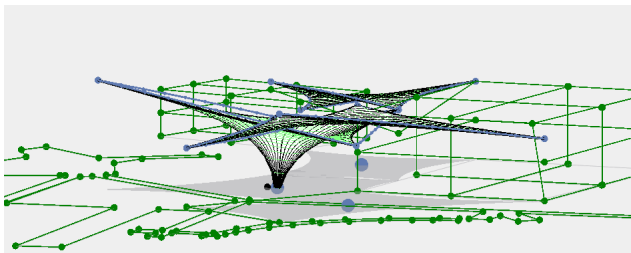
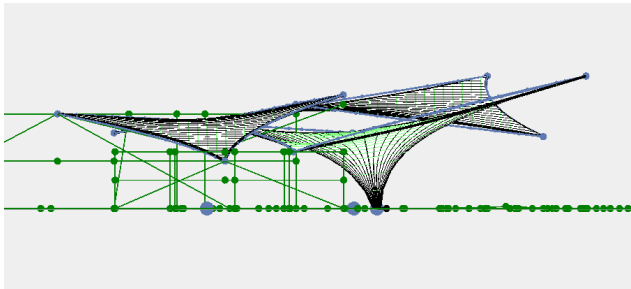
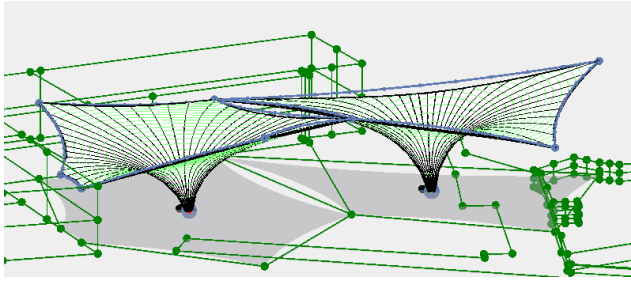
Restaurant-area, model and floor plan



In order to prevent that forces become too high the flat sails would need increased curvature. Moreover, the structure is very expensive. So I tried to work with funnels.



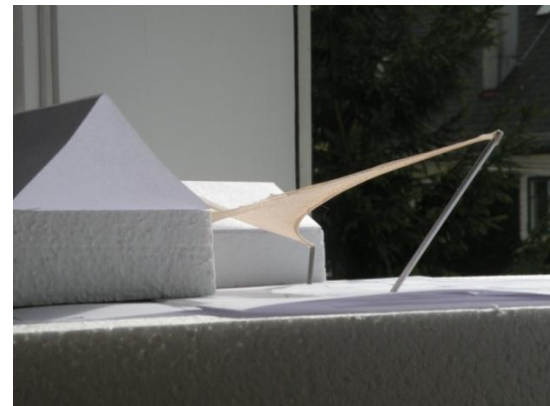
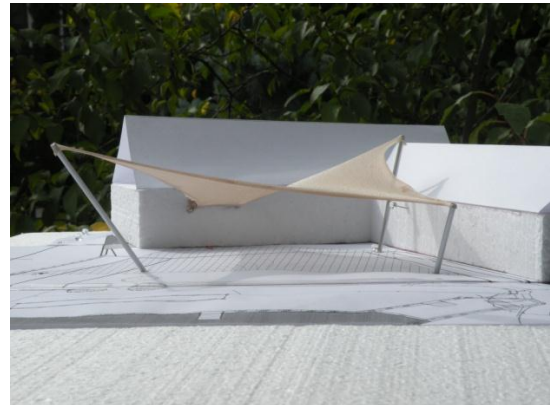
Formfinder-studies for both situations



Following the rather complex installation of the funnel construction I have tried again to install a structure in the entrance area.

Hereby I was trying to install a minimum of supports at those spots that permit an open view on the pool and the wooden cabin complex and that have as little impact as possible on the usability of sunbathing area and paths. This is also why I placed the main supporting column into the flower bed east of the entrance area;

In addition, as the highest point of the complex, it should also invite visitors to rest underneath the construction. The remaining supports are placed just in front of the sauna complex wall and thus neither affect the visitors' view nor reduce the usable surface. The sail is fastened at two points to the wall above the entrance of the building.



The model clearly illustrates considerable height differences, which result from the necessary curvature of the surface: a final form which I regard as not elegant enough in connection with the existing building stock. So I have decided to come back to the prior idea of a funnel construction.

5. Final Design

The sail constructions ought to convey an atmosphere of ease, leisure, wind, water and energy at a location where nature has provided energy in abundance. The soft and flowing membranes resemble the shape of water and thus represent a formal contrast to the historical, rectangular buildings.

In front of the restaurant, two sails measuring 50 and 70 square meters are supposed to form a structure that is easy to operate. The sails will be fastened on three respectively two points to the walls of the surrounding buildings, each with a low point in the chestnut tree that also fulfils the task of shading the remaining area. With a trunk diameter of one meter the tree can also be used for force absorption. The sail in the south forms, together with the high point and one of the supports, a distinctive landmark: here is where visitors are shown the entrance to the outdoor area of the restaurant, coming from Badgasse as well as from the Café.

Both sails are going to be in use on a temporary basis only, installed in spring and de-installed in autumn. If need be, installation and dismantling can be done by internal staff (two persons).

As a pendant to the sails a funnel construction is going to be installed in the entrance area. Not only due to the curvature but also thanks to the association of its form with a gushing spring does it seem to offer an appropriate design.

This area is also supposed to host events and thus to be, if partially, covered by a temporary roof structure. The construction can be installed by three persons in April or May and dismantled in September. The view on the pool and the cabins remains unhindered, supports will be placed in the flowerbeds and the edges of the usable spa area only.

6. Conclusion

In the introduction I had asked about an adequate answer to the style and design of a turn-of-the-century building, from both an architectural and constructional perspective.

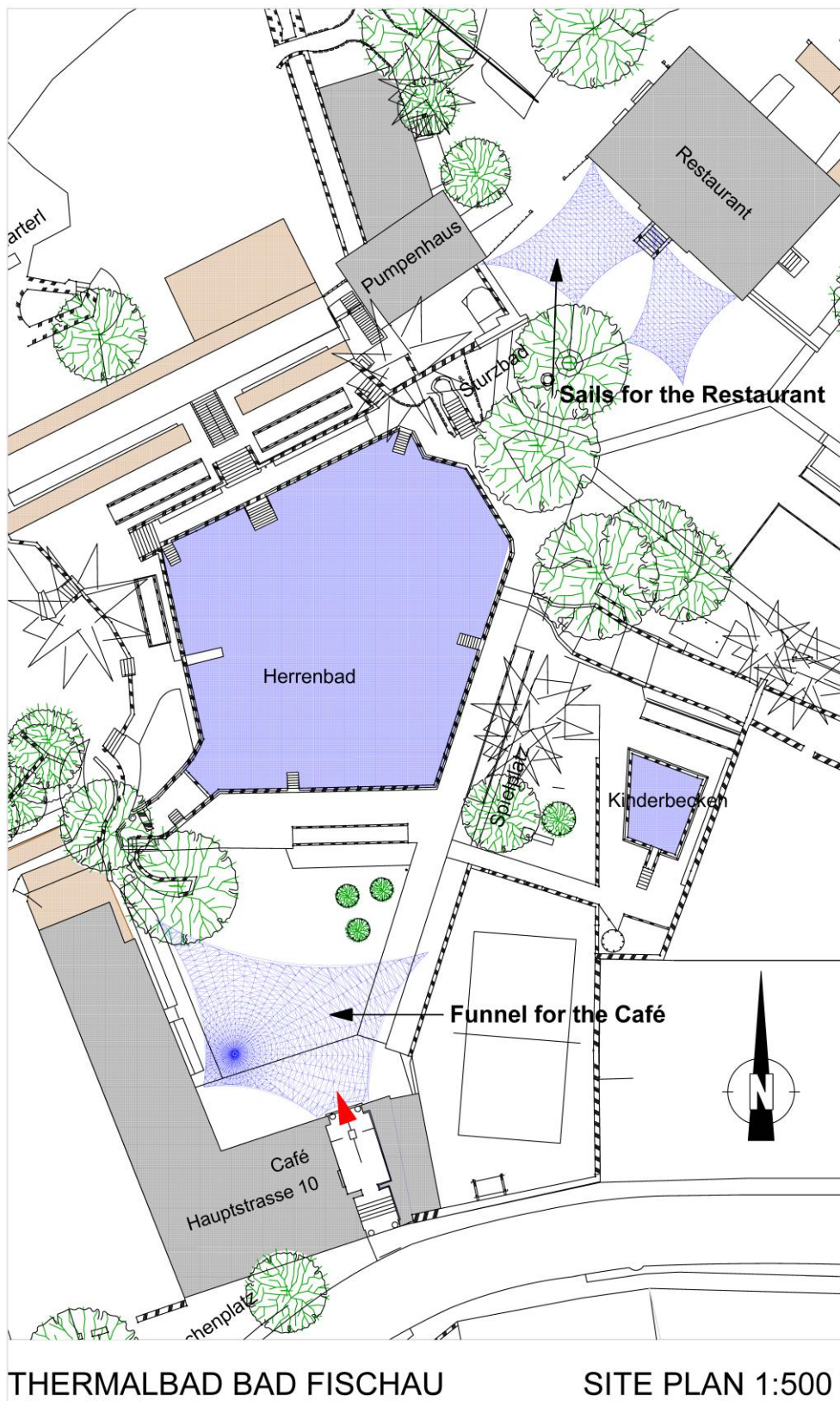
I have tried to visualize the energy of the historical site through the membrane structures. Respecting the historical site has been of utmost importance to me as the site can never defend itself. The sails reflect the waves, the funnel mirrors the springs. They are simple constructions indeed, yet they fulfill shelter, cost, aesthetical and operational requirements. These constructions form a tension-fraught yet hardly dominating contrast to the existent planting and the construction of stone and timber elements.

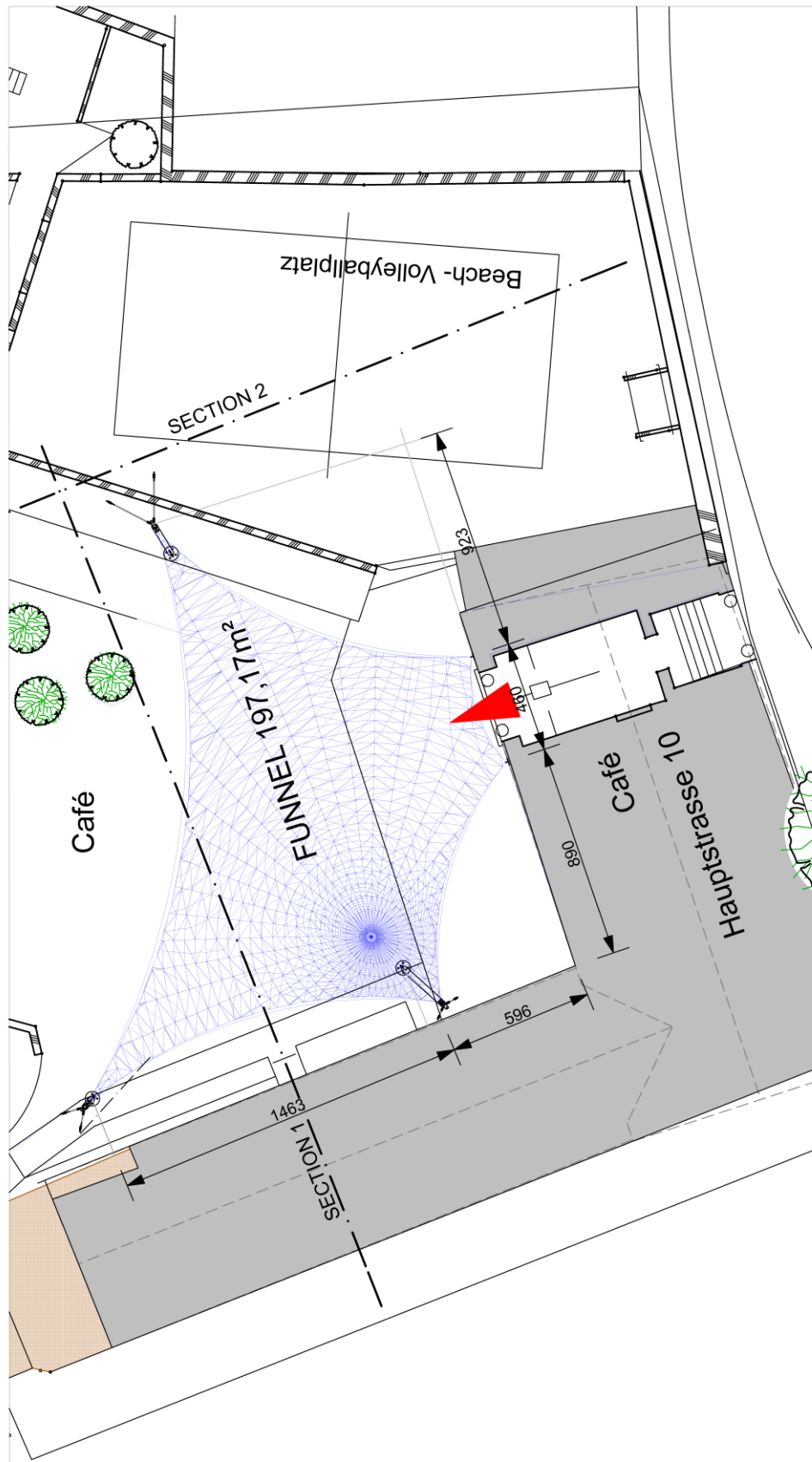
The above mentioned tension results of course from the use of most diverse material for the exterior design, such as light and flexible textile fabric, mounted and anchored with the help of ropes and belts as well as massive stone masonry in combination with timber buildings on the one hand. On the other hand, suspense has also been brought in through the use of completely different forms: massive, straight and rectangular constructions with saddle and hip roofs contrast with soft, floating and modifiable membranes.

“Which element dates from which time?” is a question that has thus clearly been answered, and a basic preservation order requirement has been fulfilled.

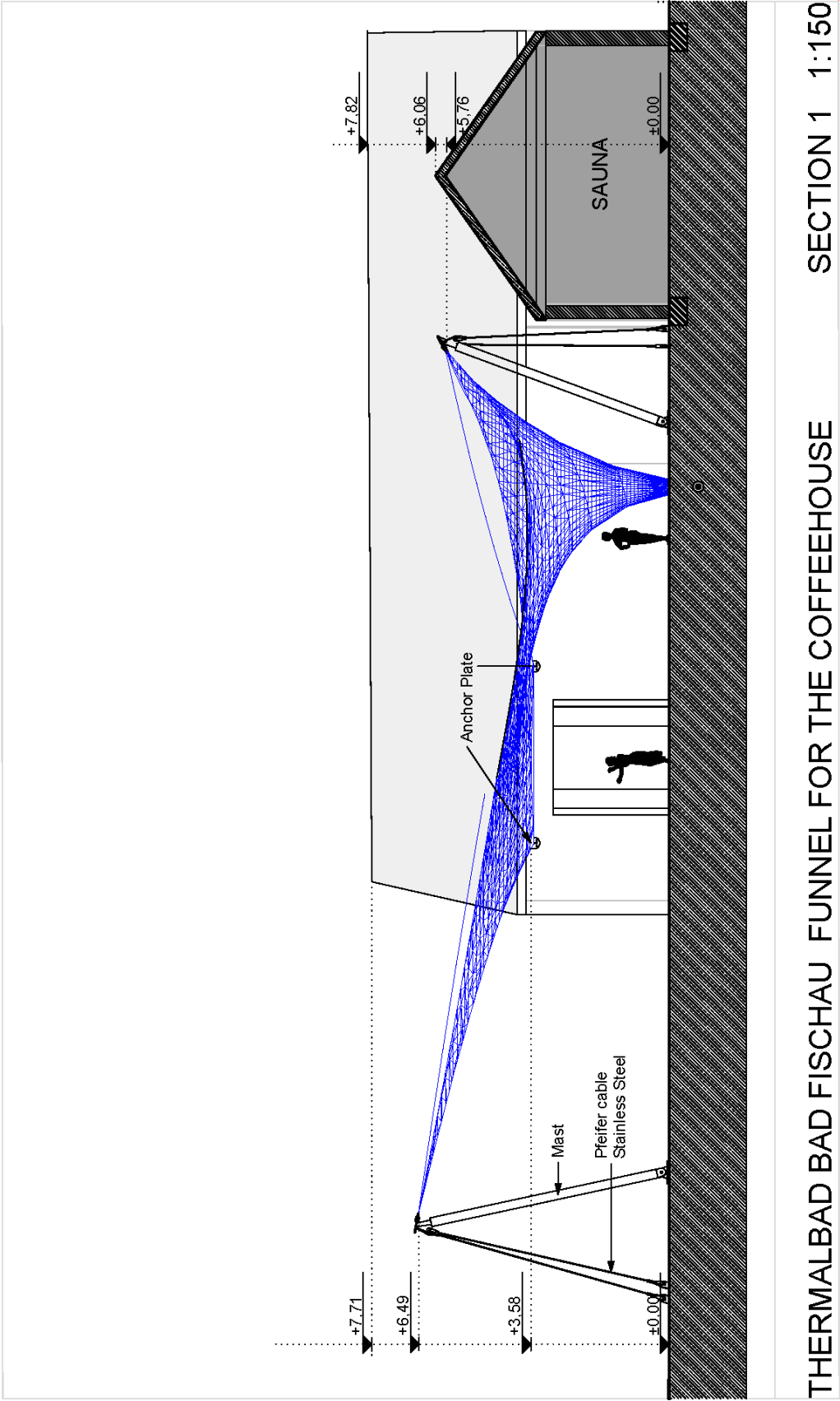
The final question then, which forms I am supposed or allowed to add to the existing buildings, proves superfluous as the form derives from the construction itself.

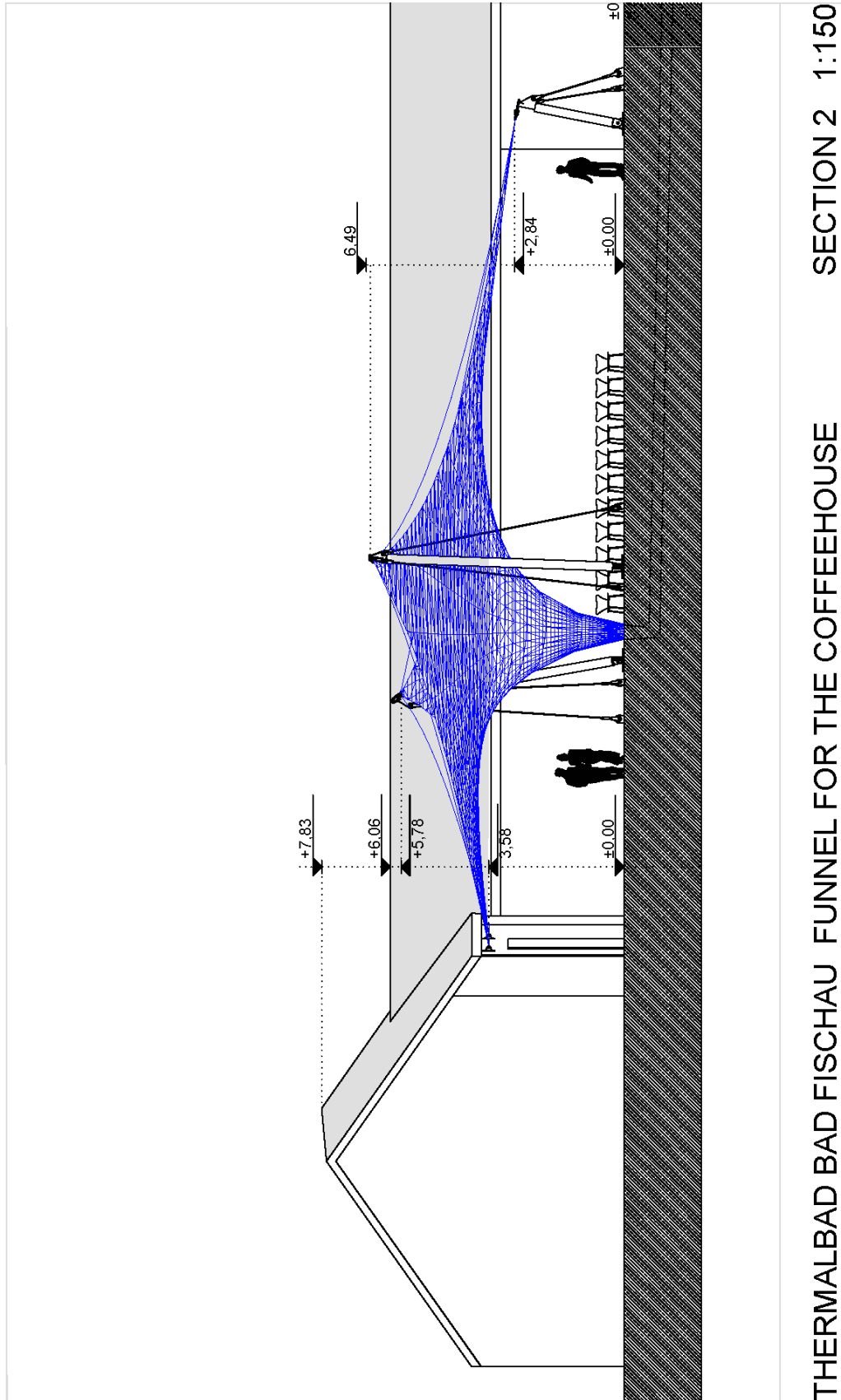
Vienna, October 2012

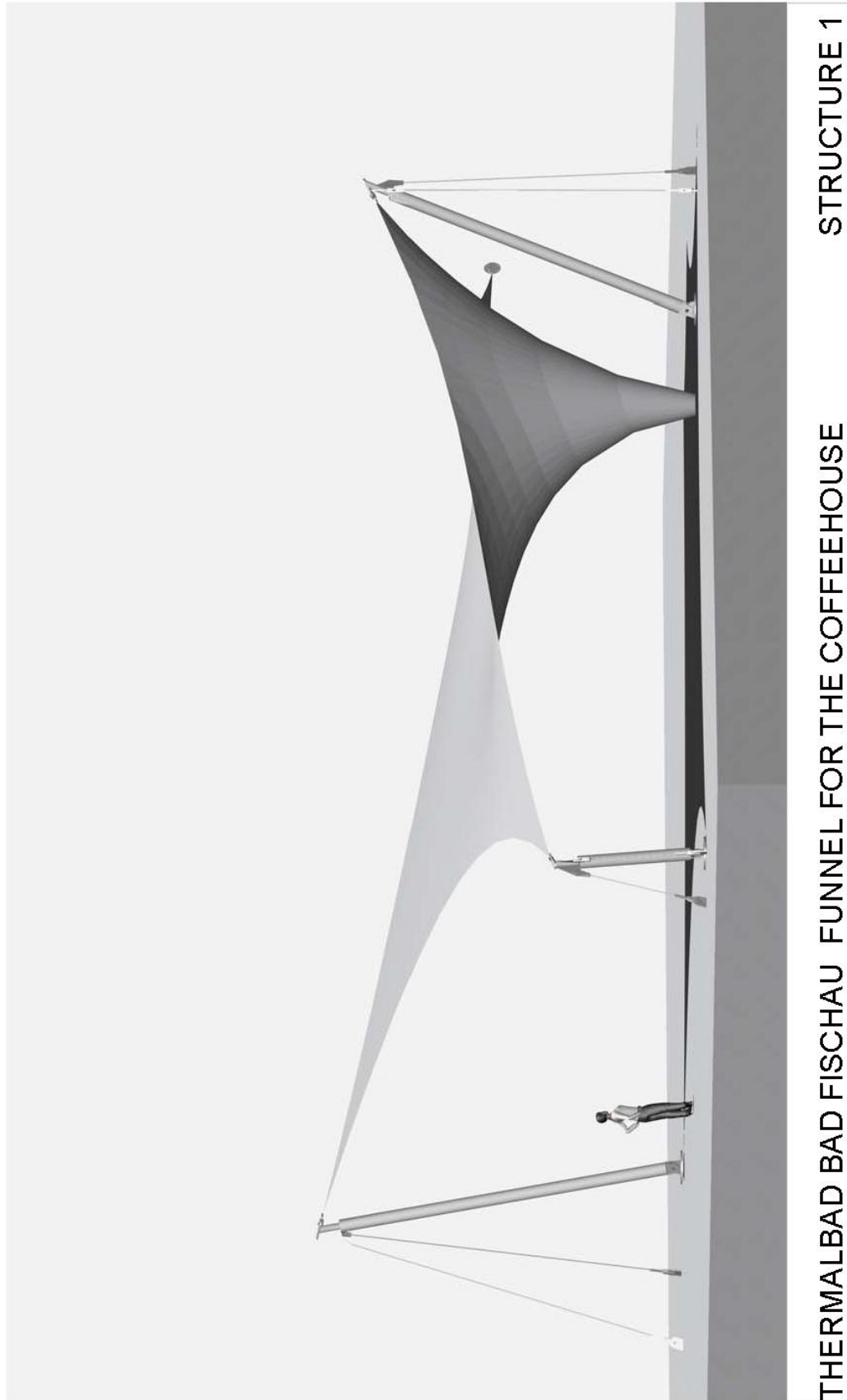




THERMALBAD BAD FISCHAU FUNNEL FOR THE COFFEEHOUSE FLOOR PLAN 1:250

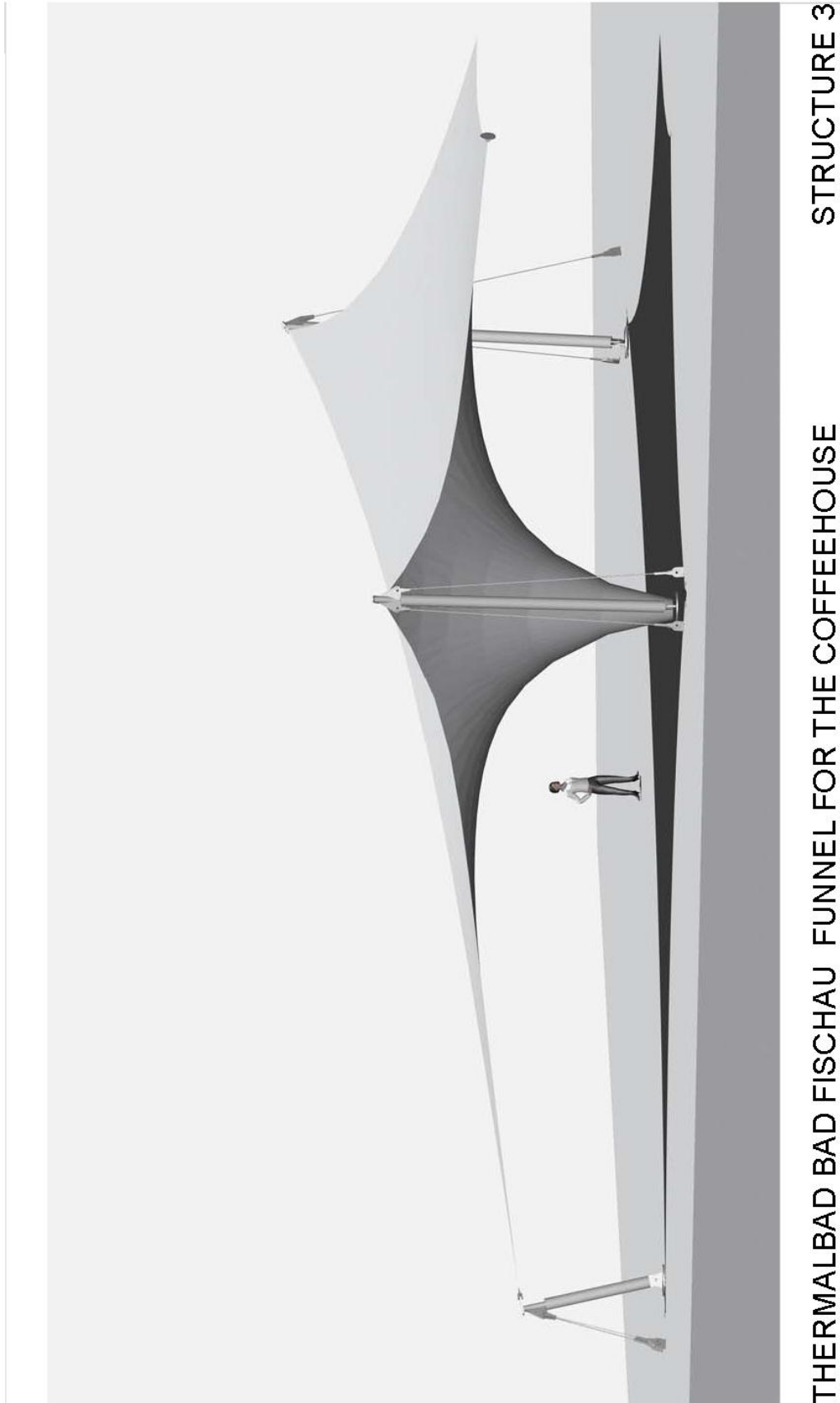


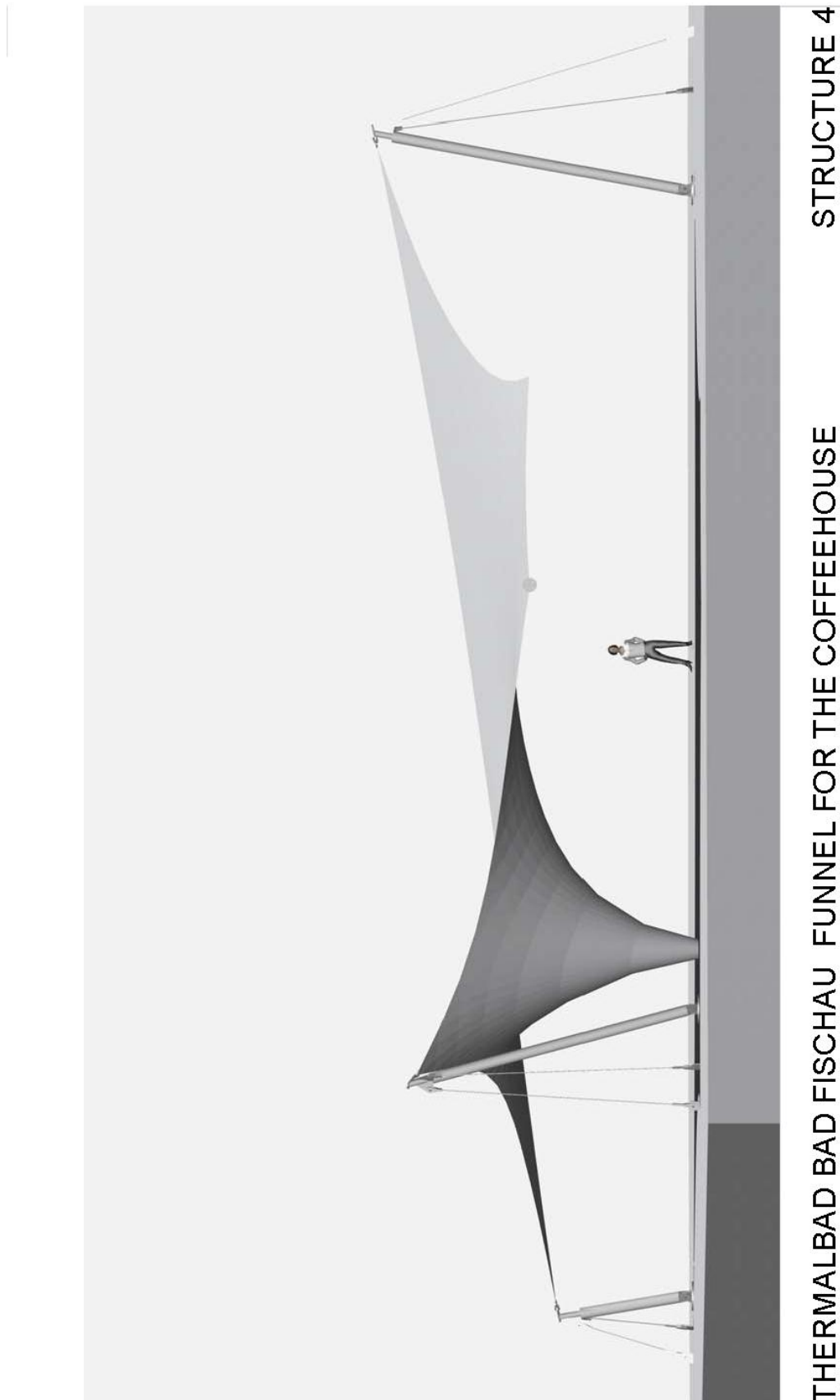


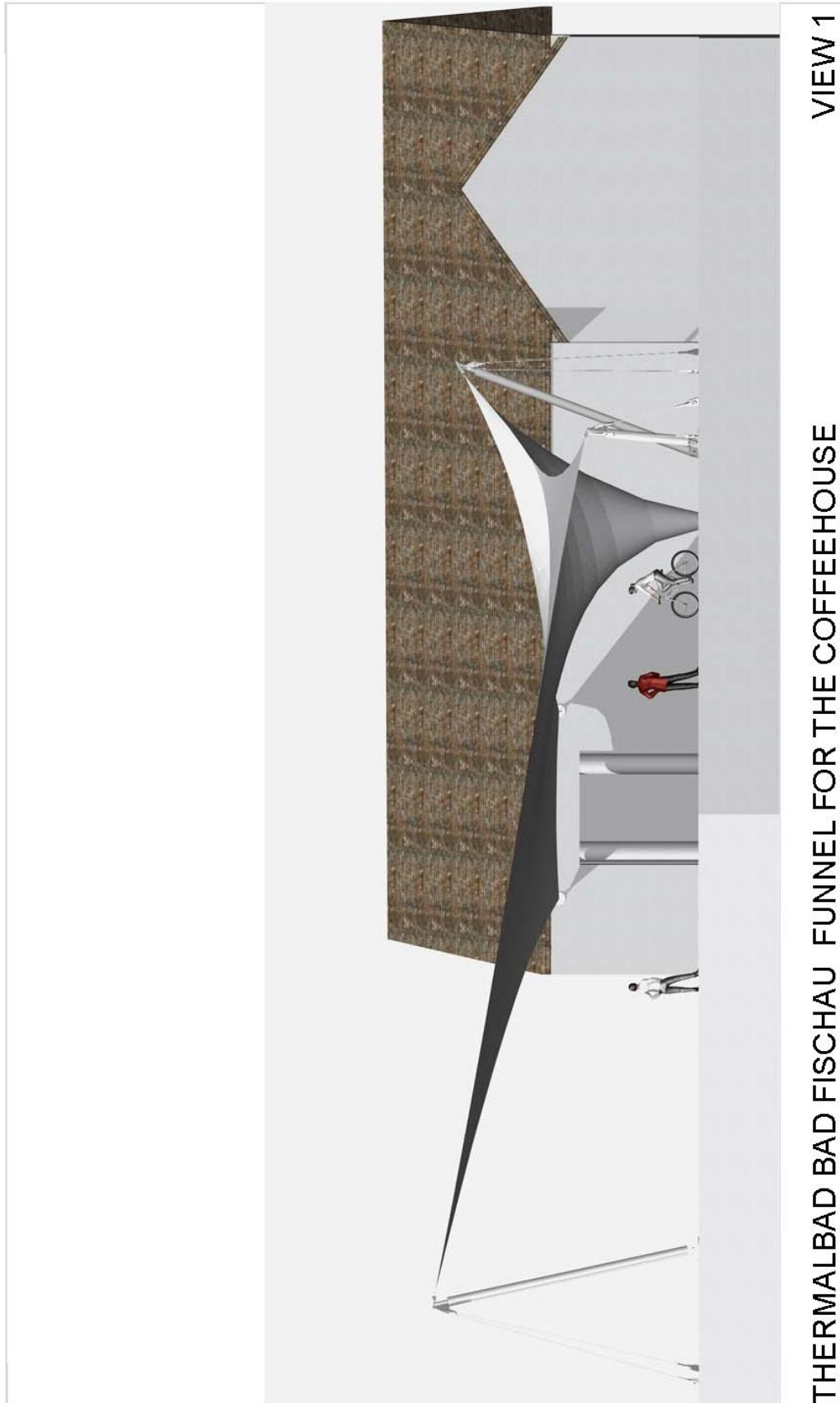


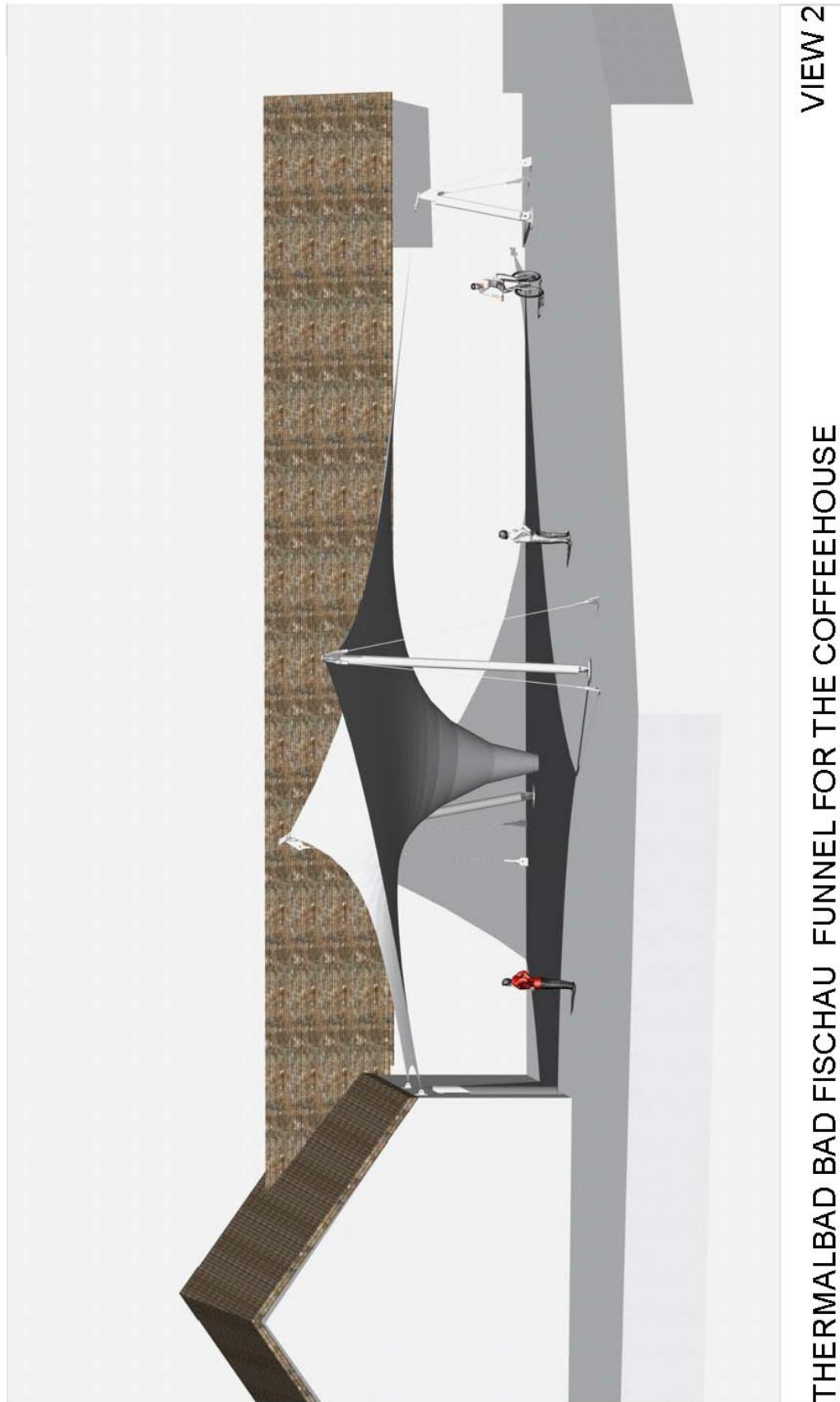


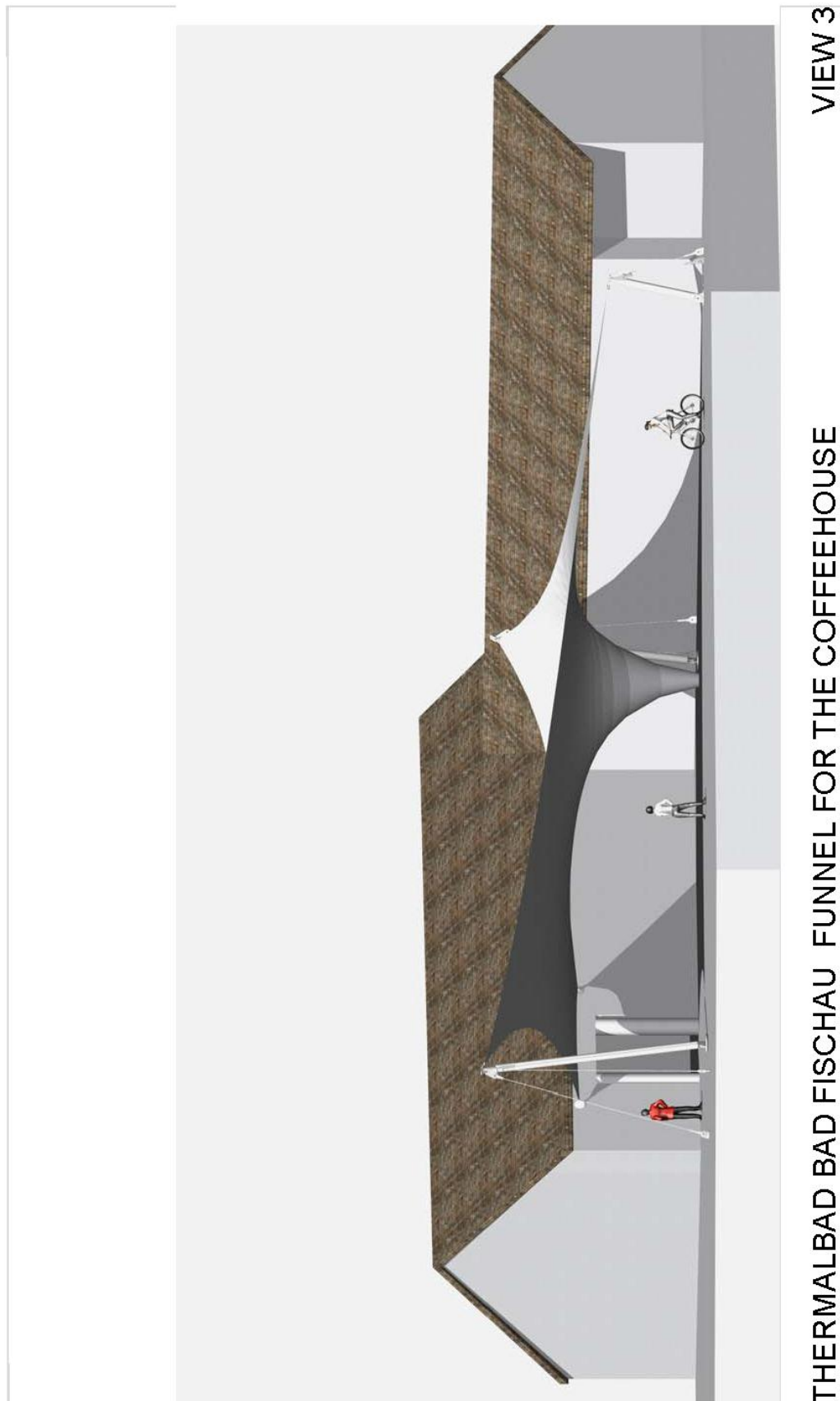
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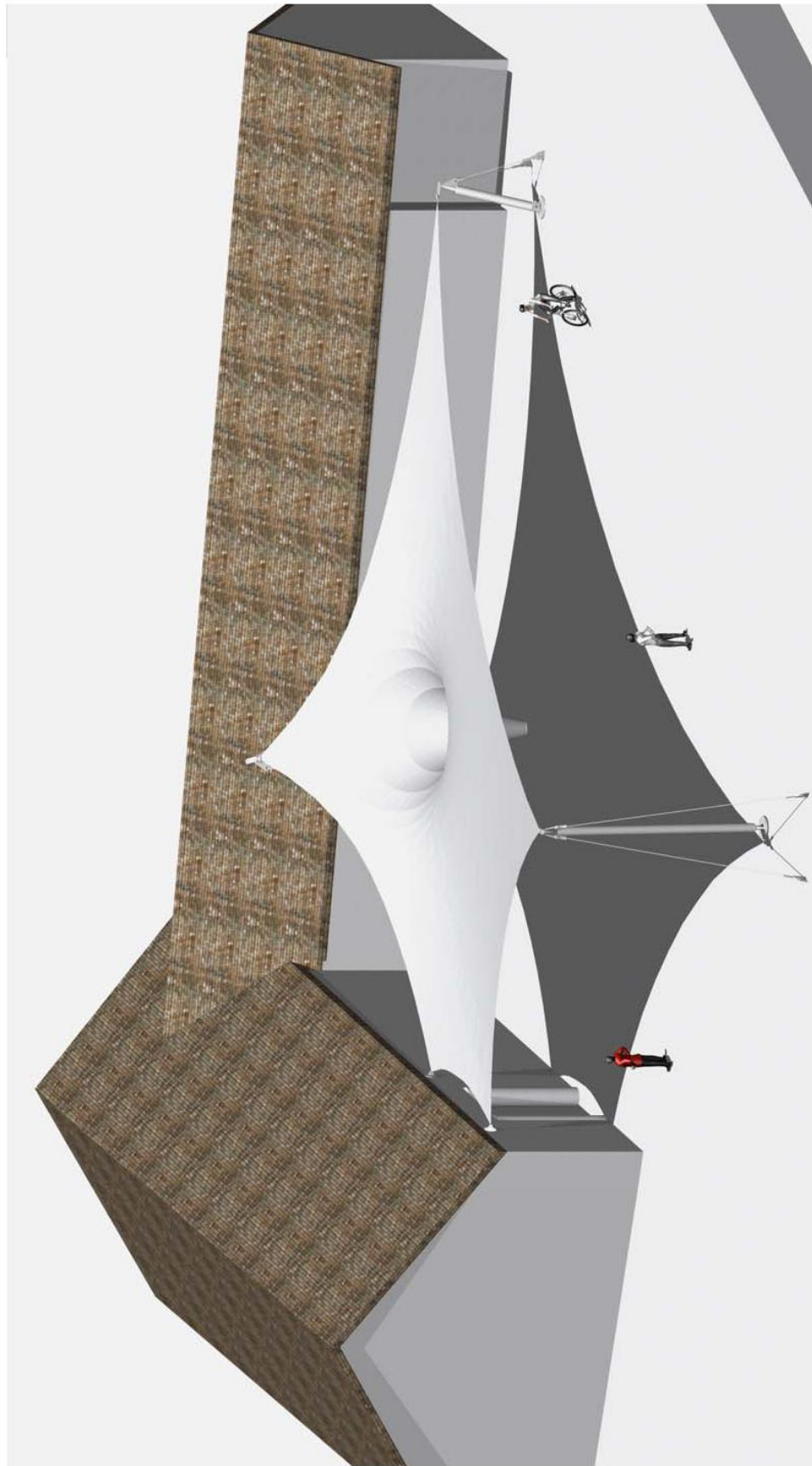










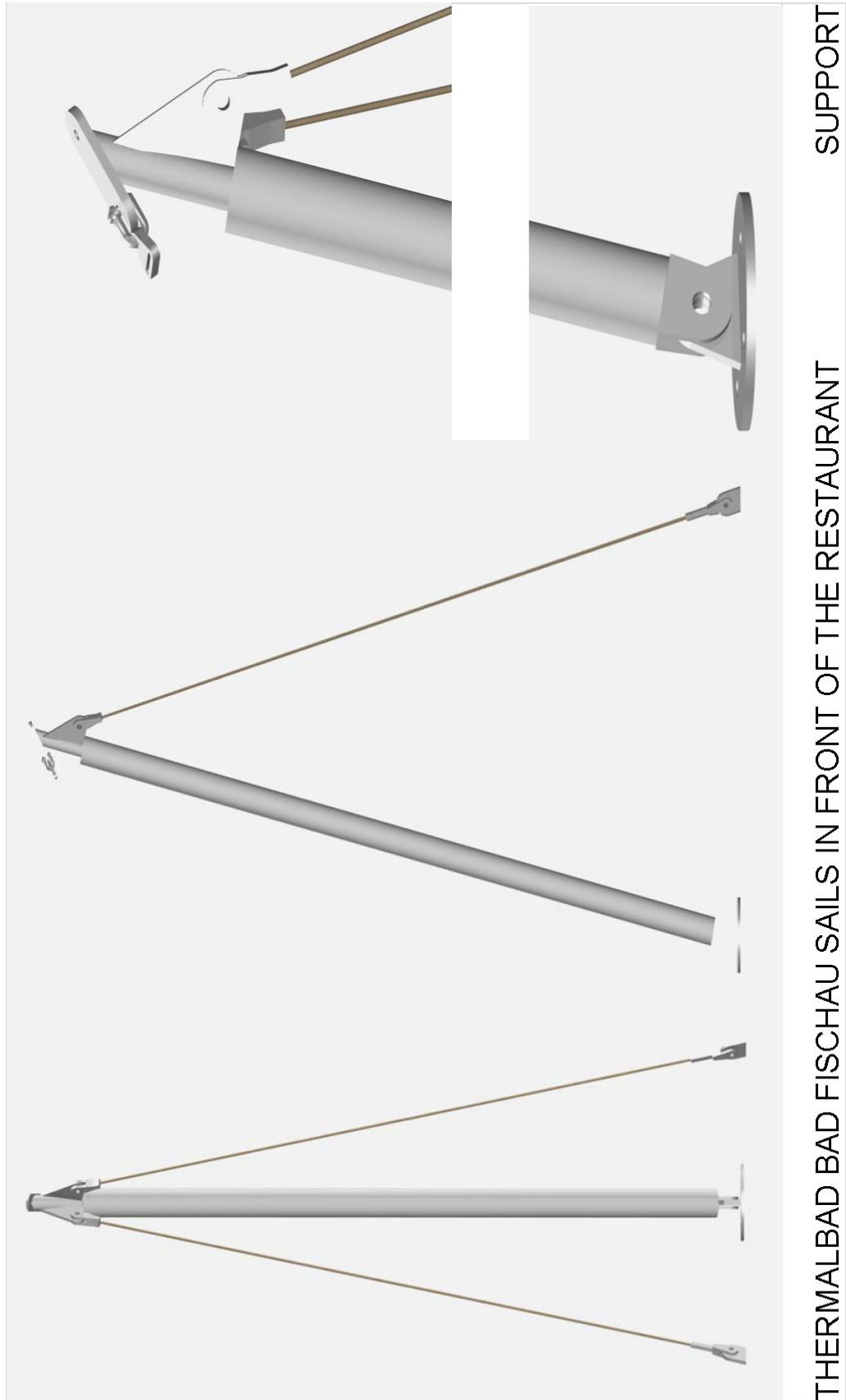


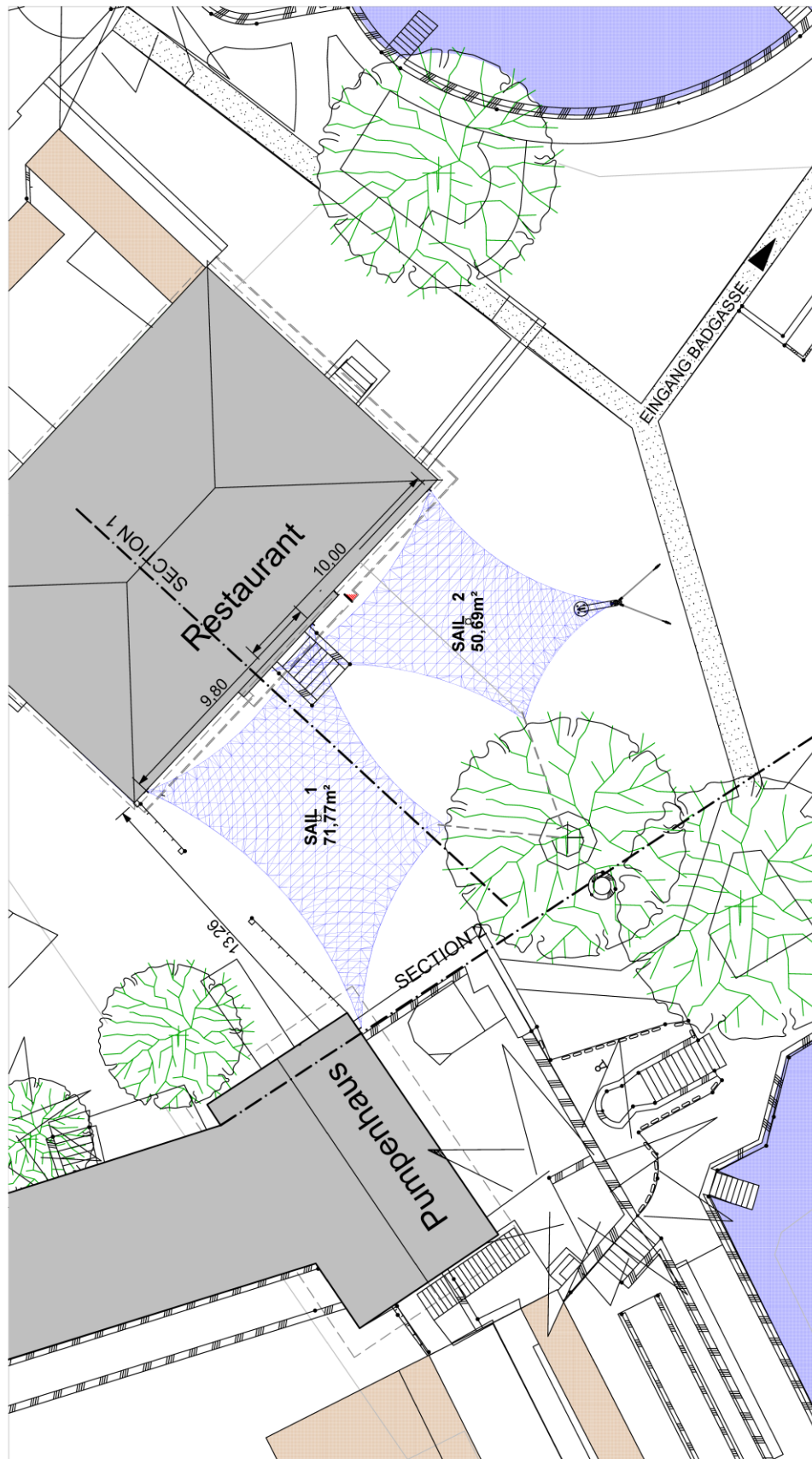
THERMALBAD BAD FISCHAU FUNNEL FOR THE COFFEEHOUSE

VIEW 5

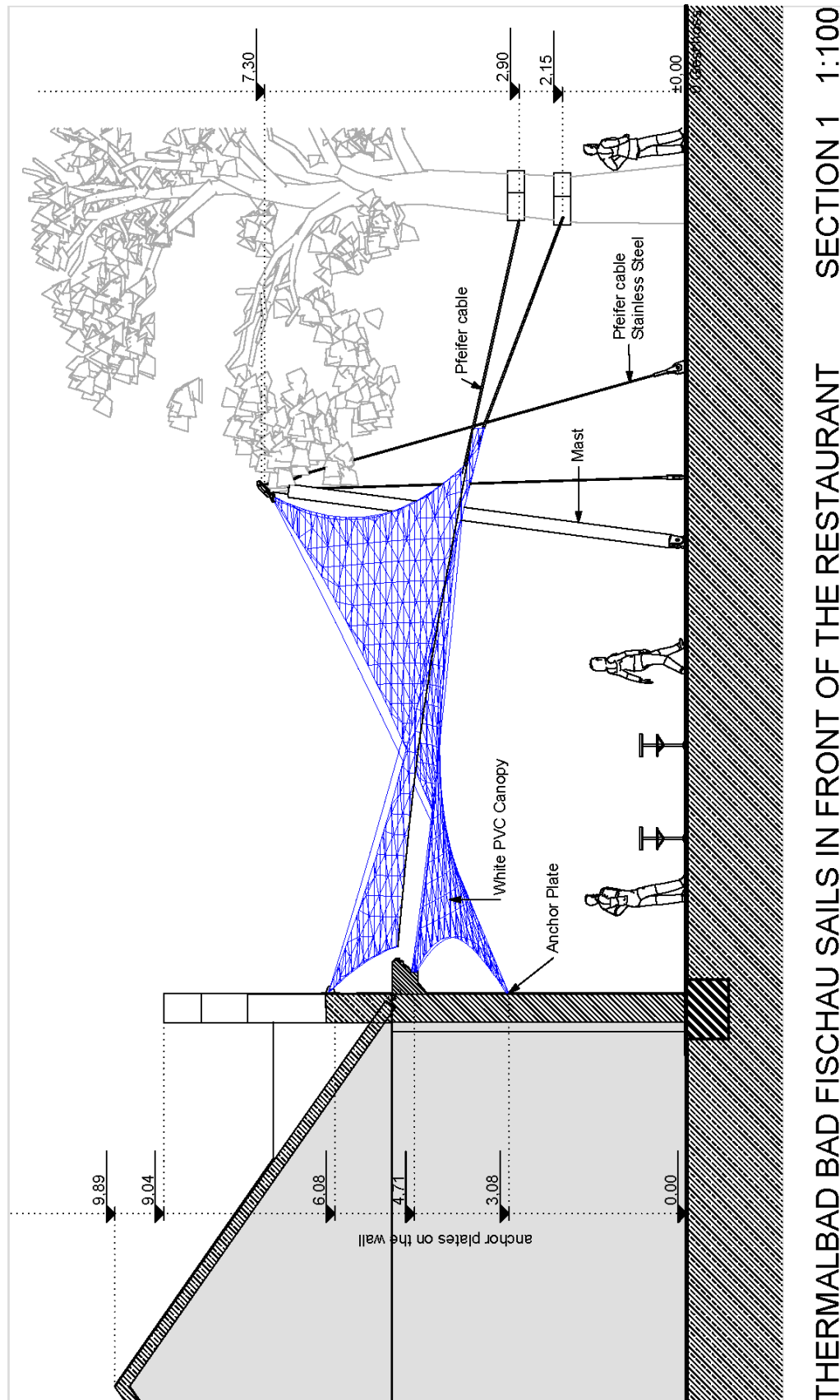


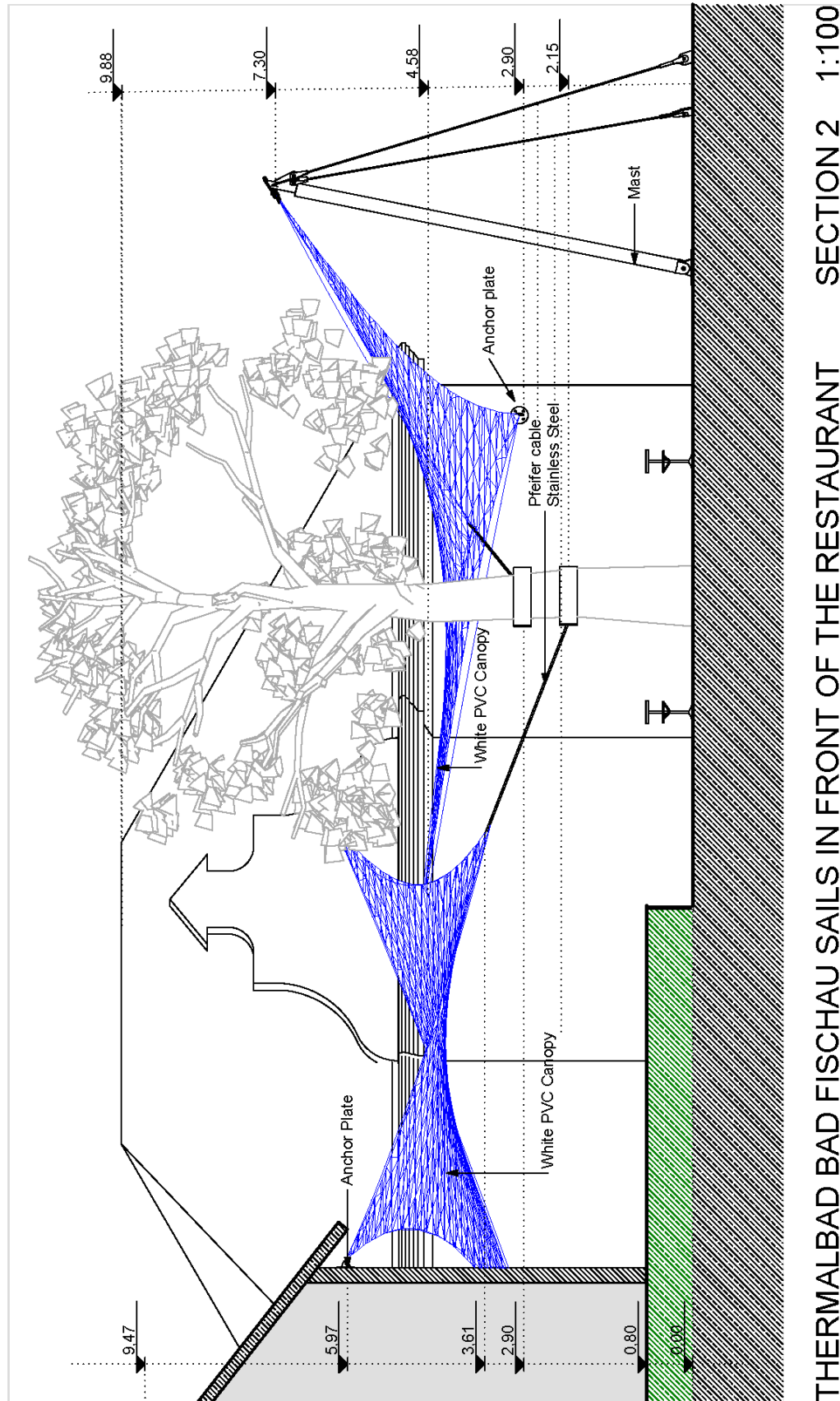
THERMALBAD BAD FISCHAU FUNNEL FOR THE COFFEEHOUSE PHOTOMONTAGE



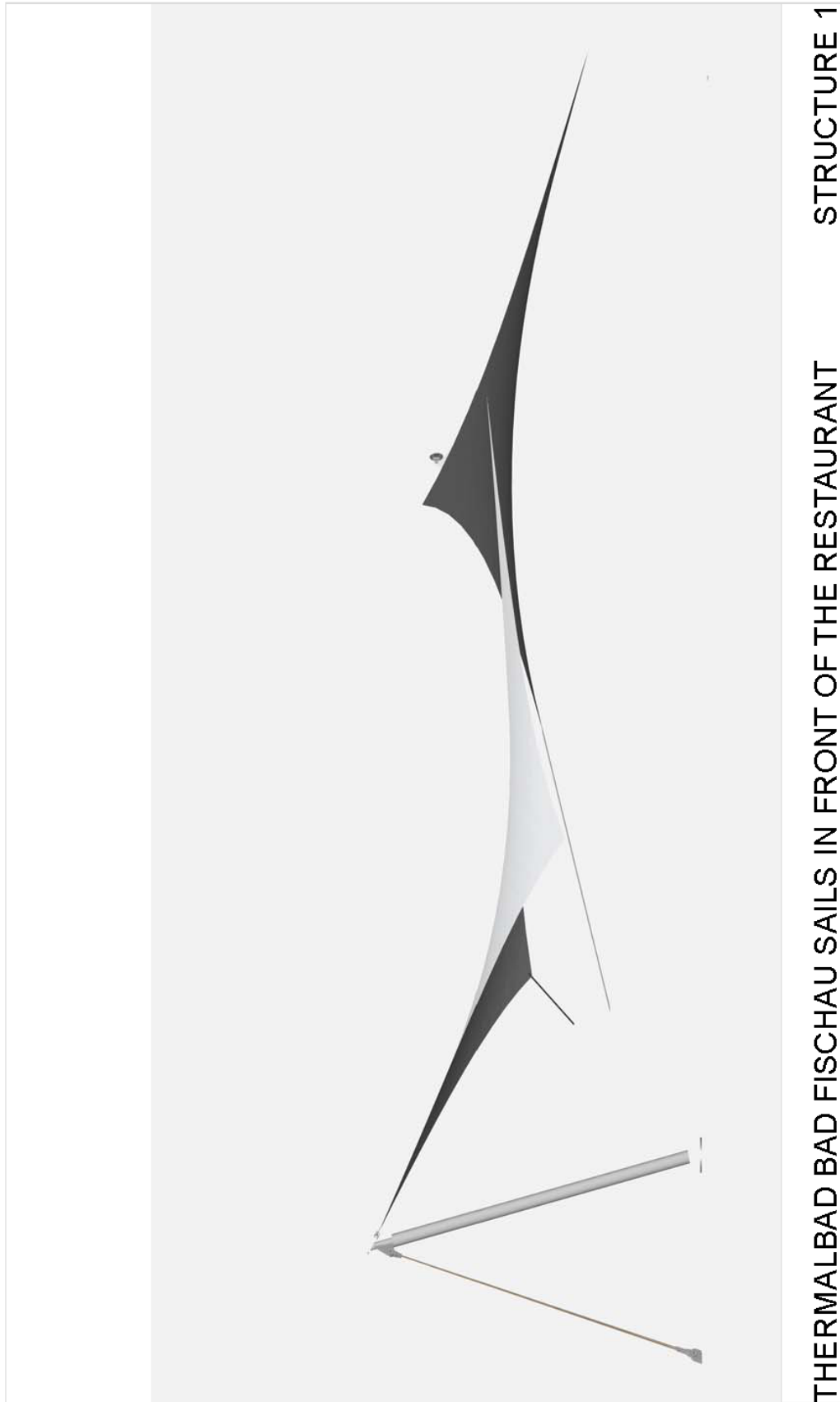


THERMALBAD BAD FISCHAU SAILS IN FRONT OF THE RESTAURANT FLOOR PLAN 1:250

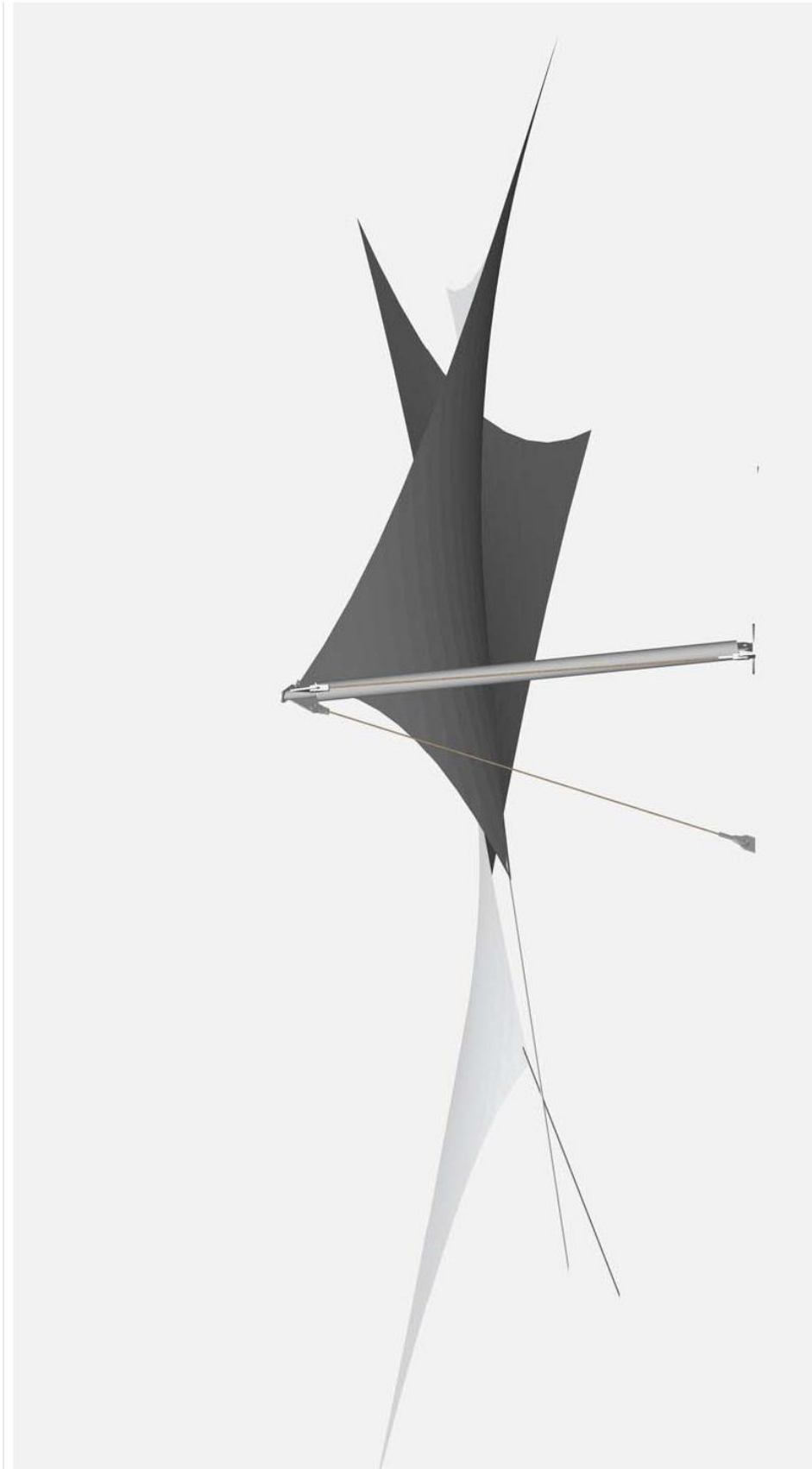




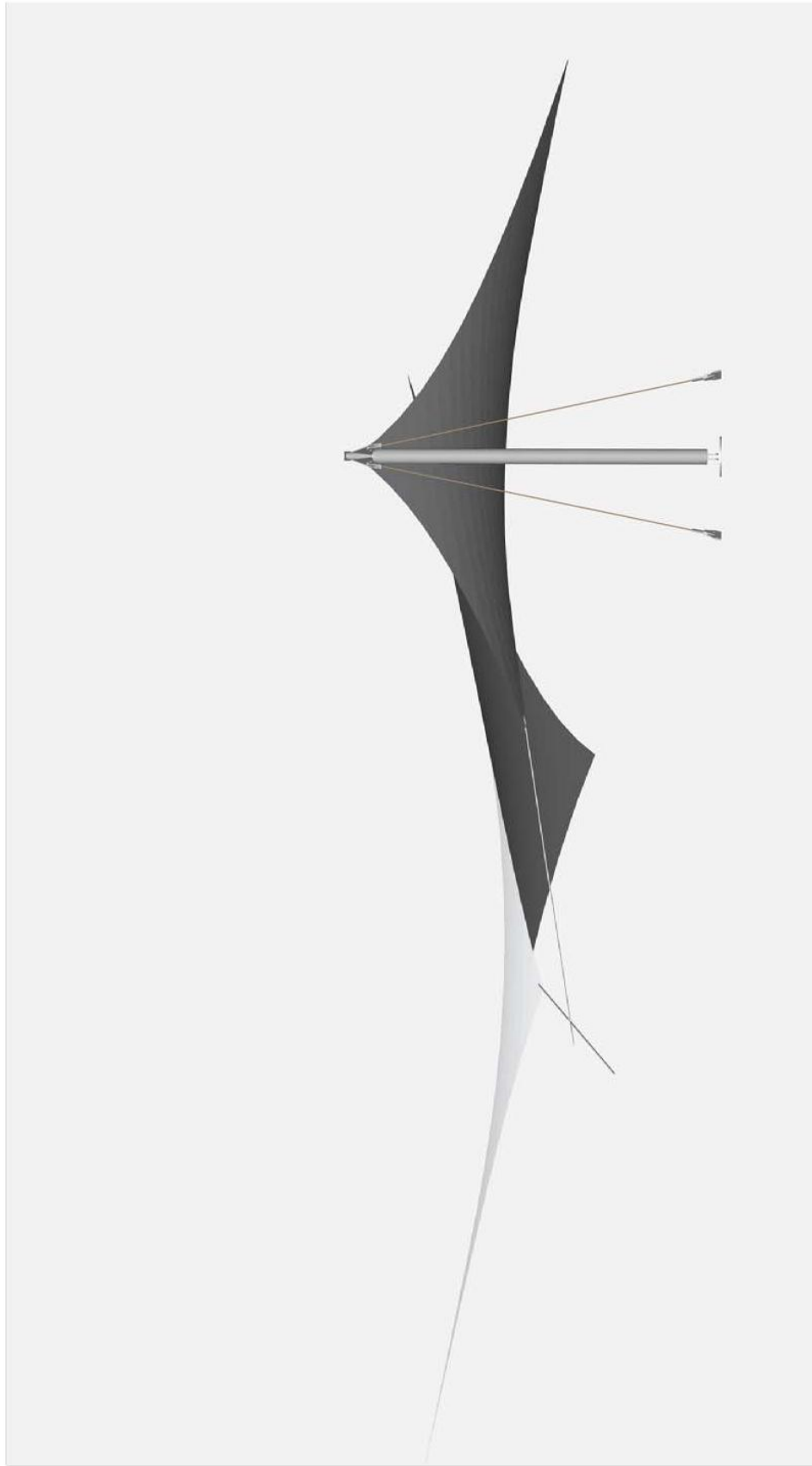
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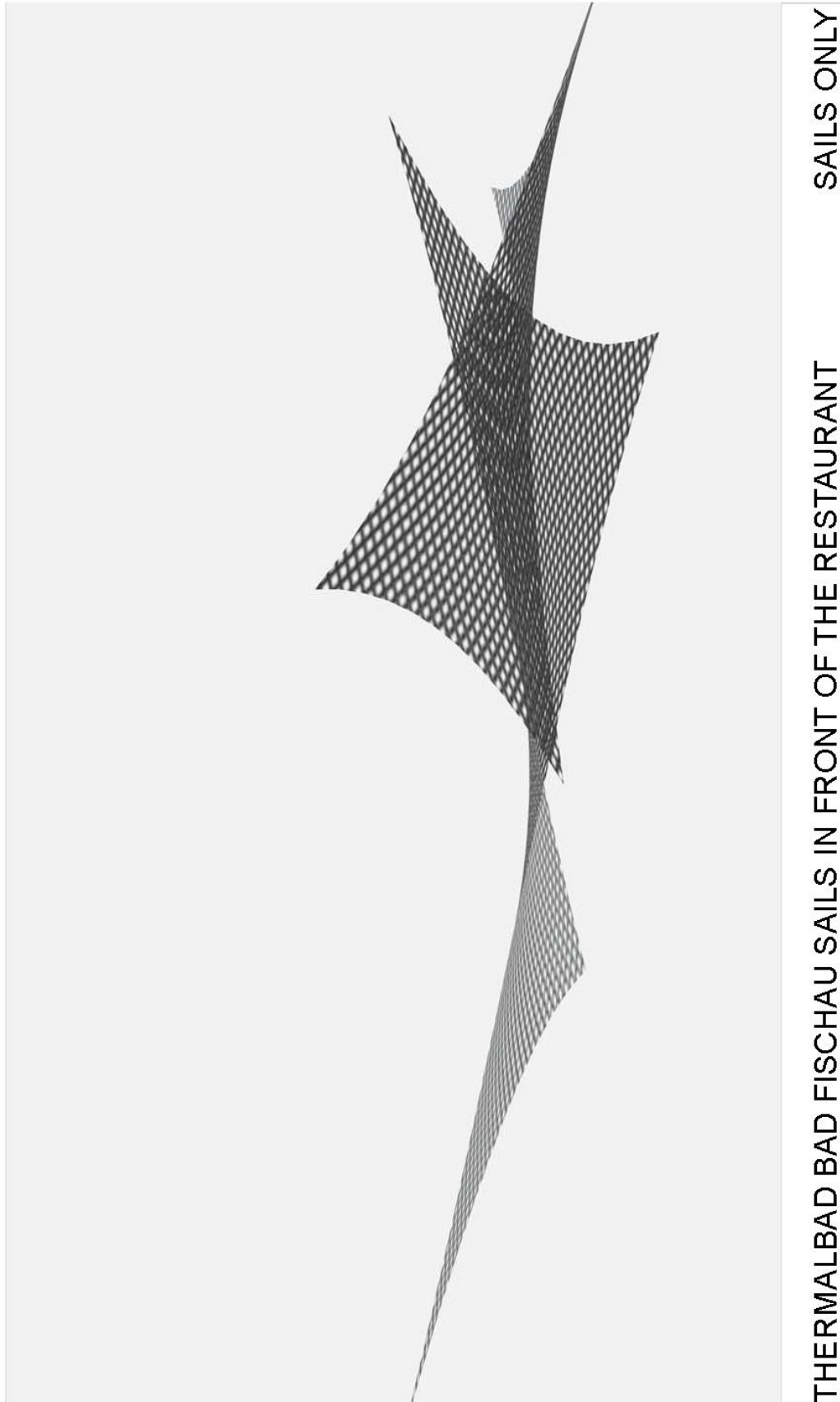
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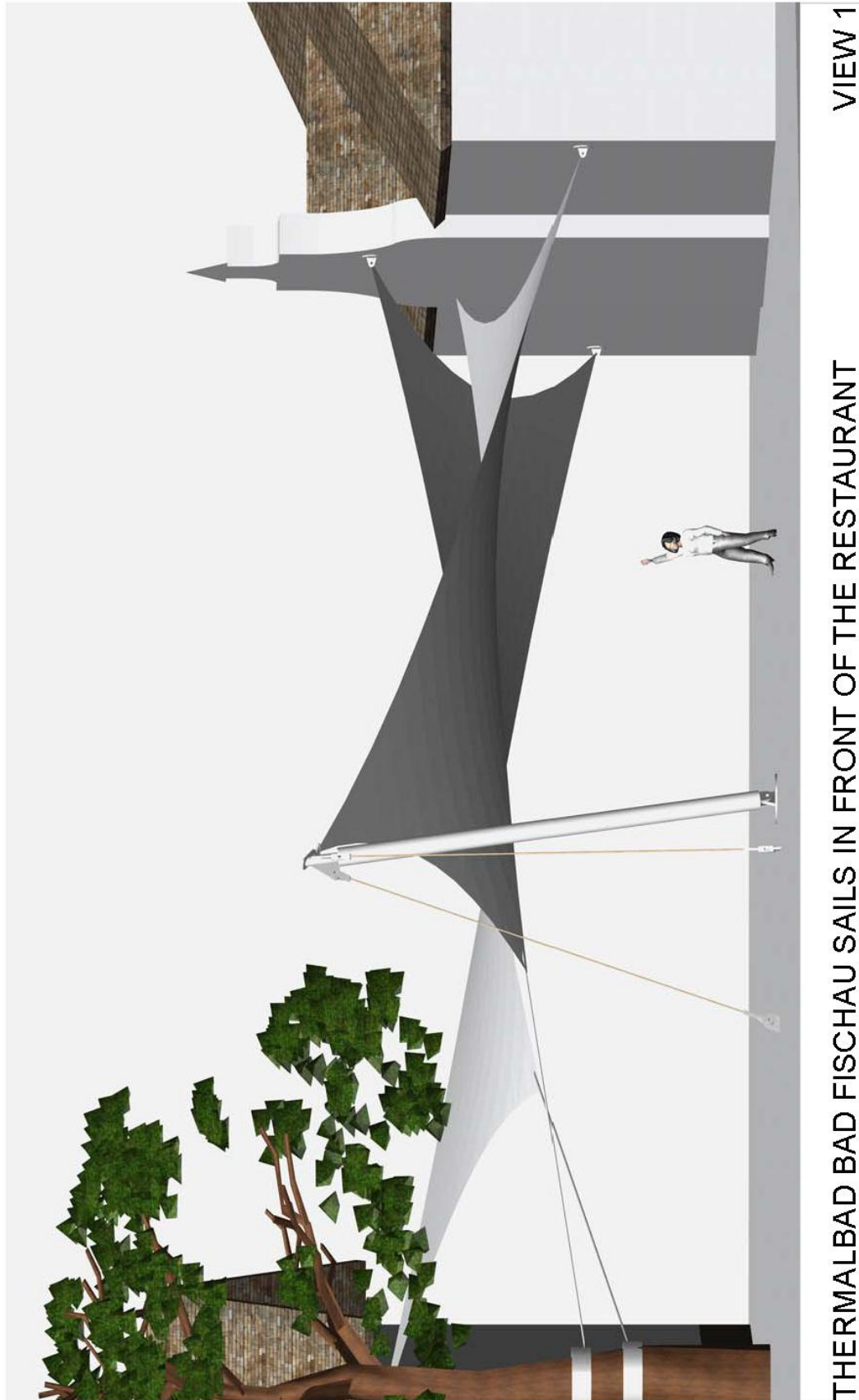
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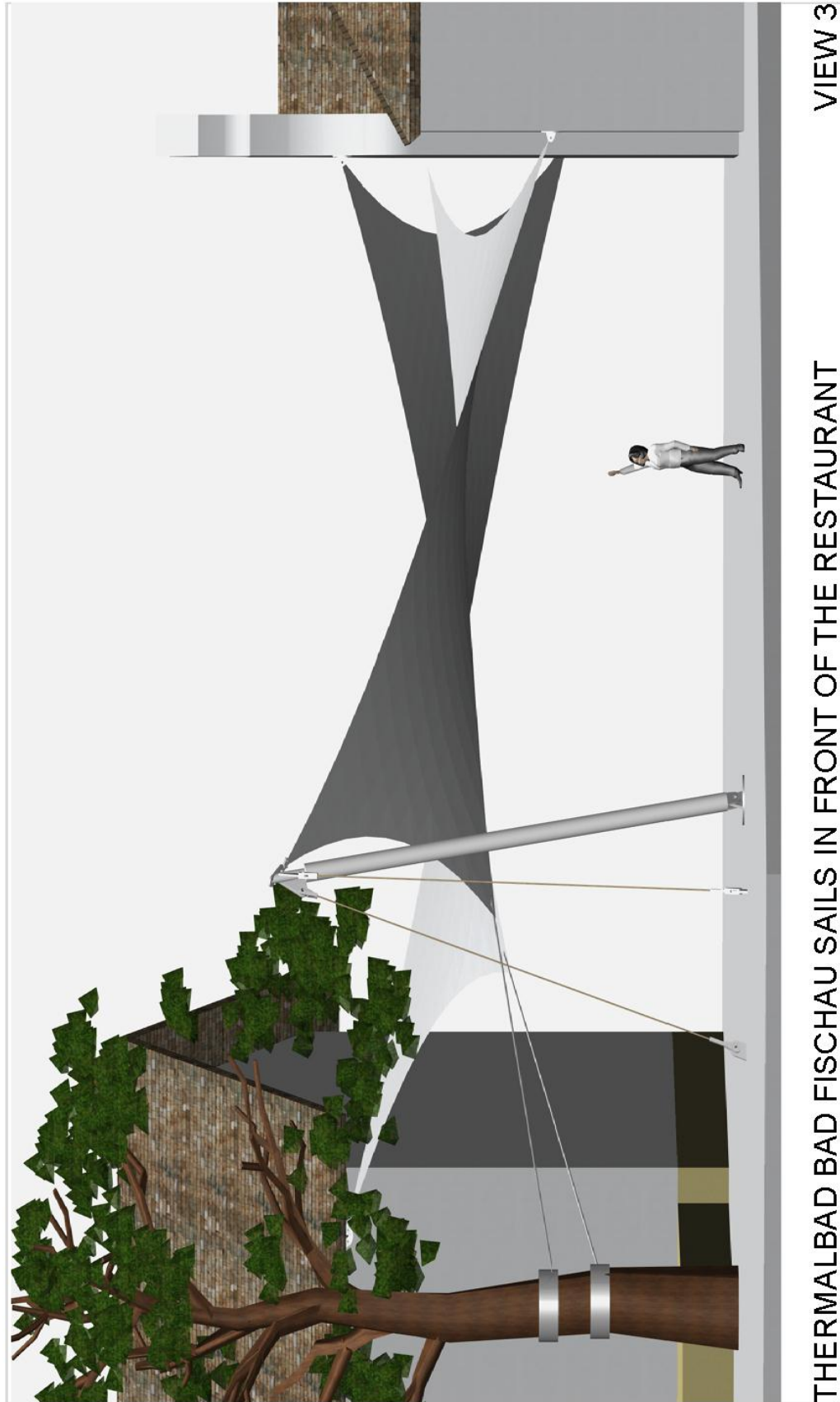


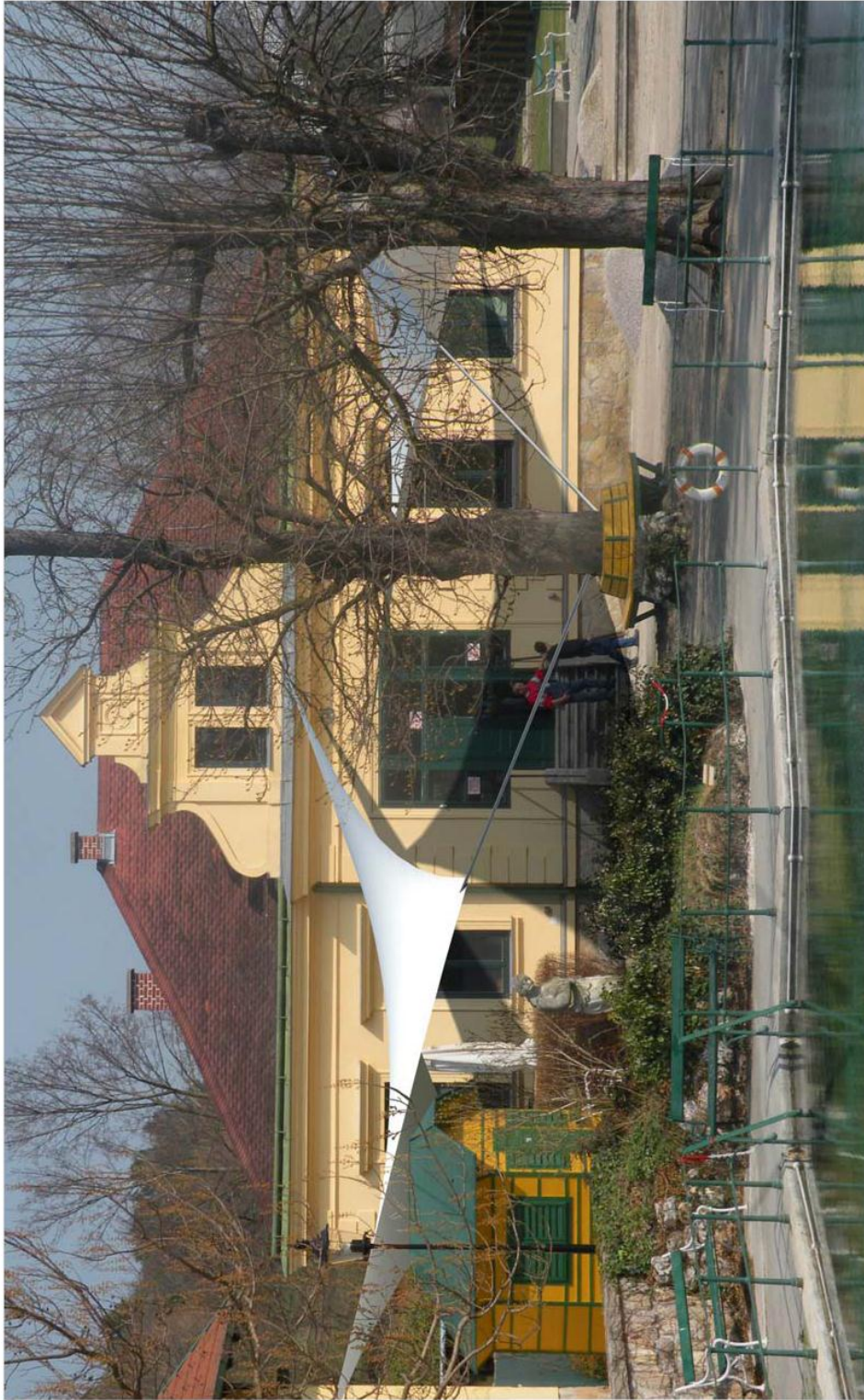
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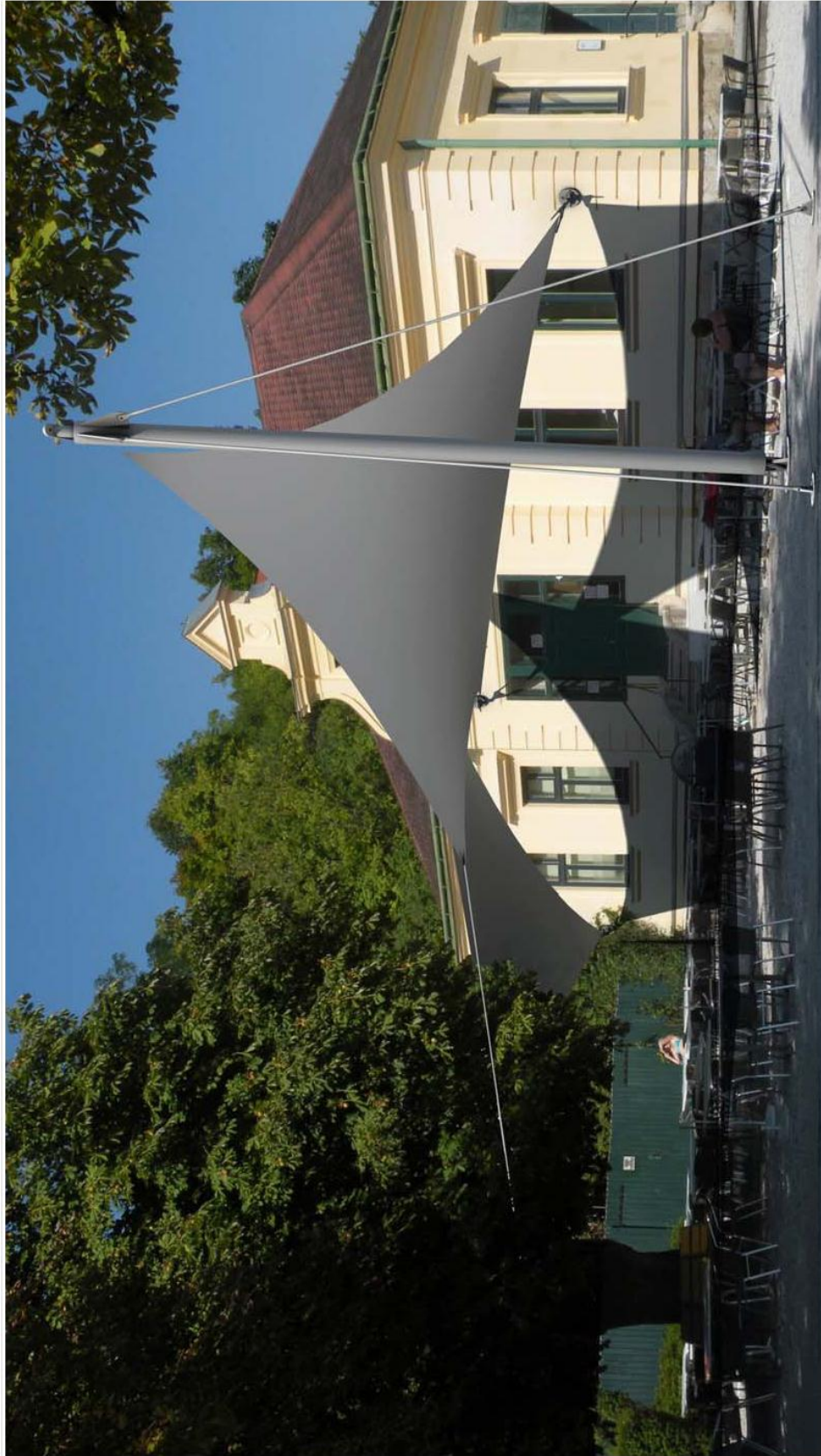
THERMALBAD BAD FISCHAU SAILS IN FRONT OF THE RESTAURANT SAILS ONLY







THERMALBAD BAD FISCHAU SAILS IN FRONT OF THE RESTAURANT PHOTOMONTAGE 1



THERMALBAD BAD FISCHAU SAILS IN FRONT OF THE RESTAURANT PHOTOMONTAGE 2

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