Urban wave
Group 2

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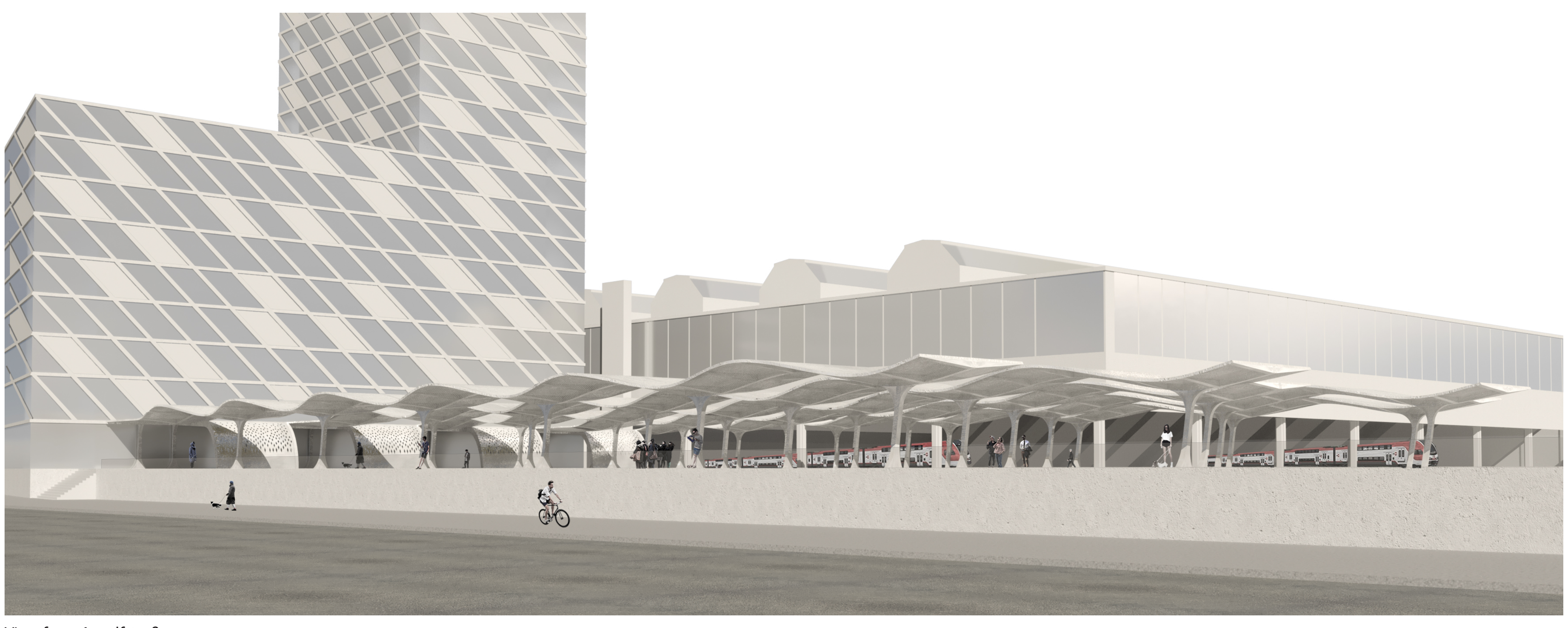
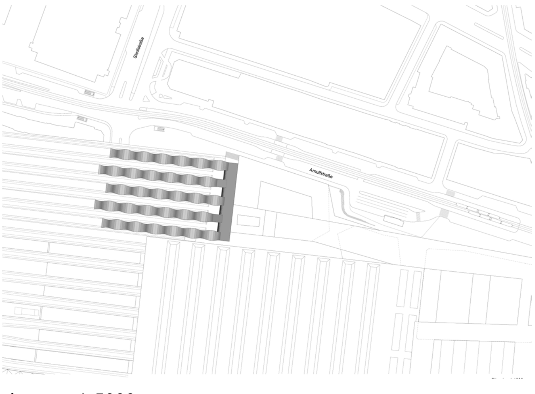
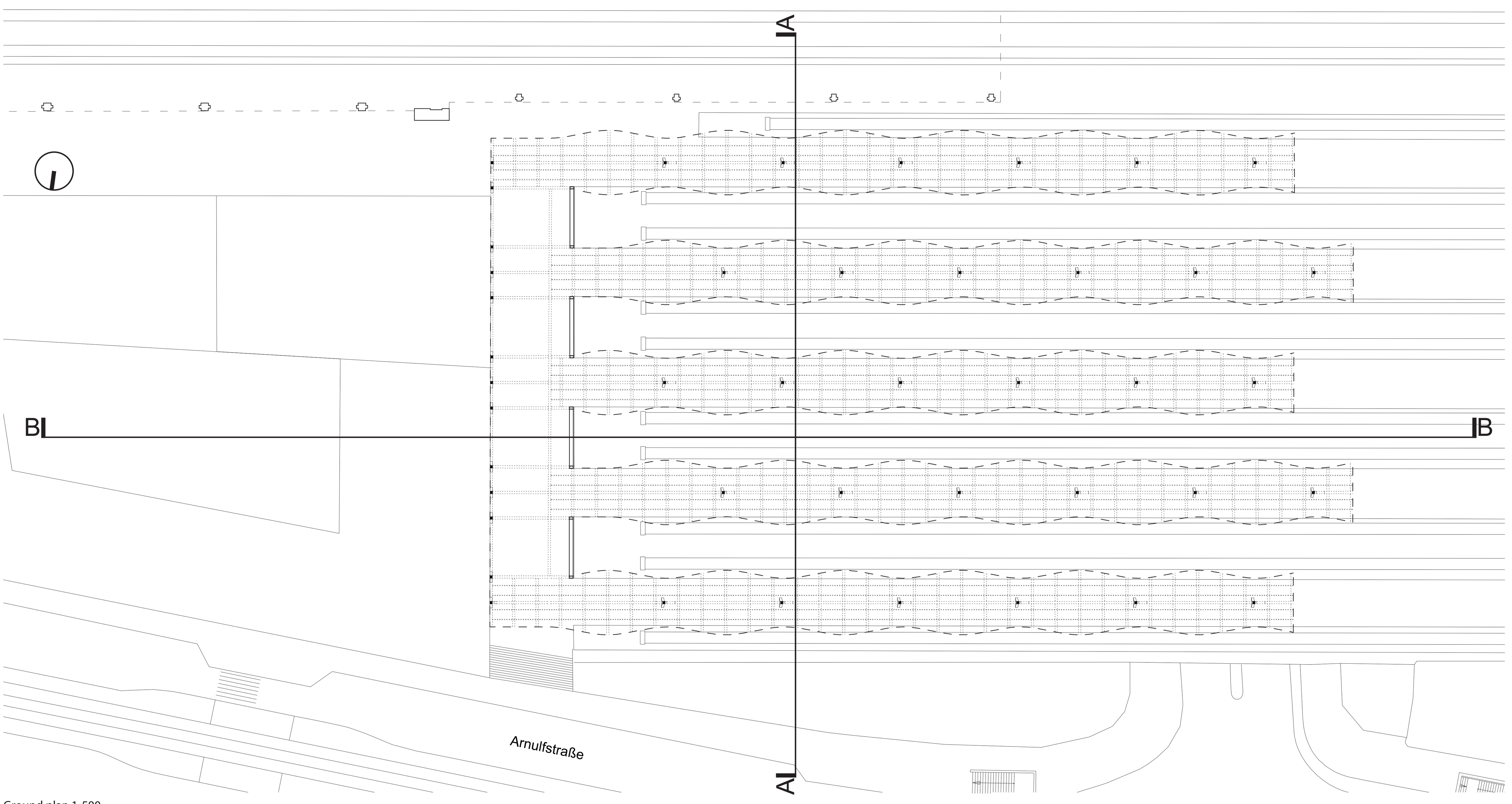


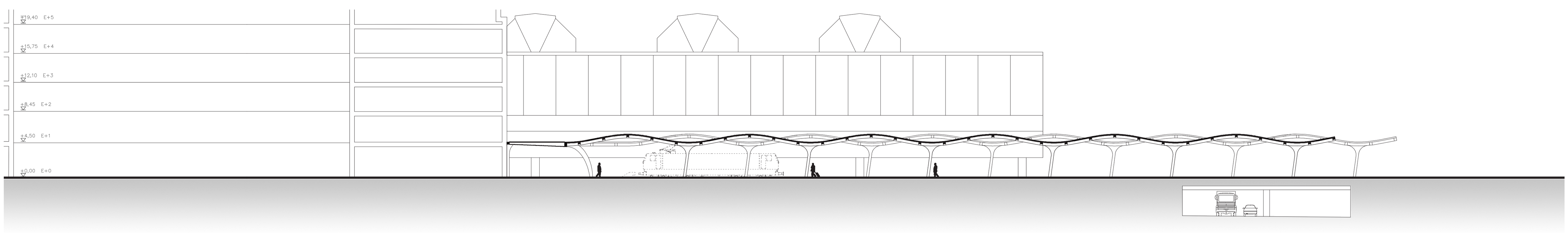
View from Arnulfstraße



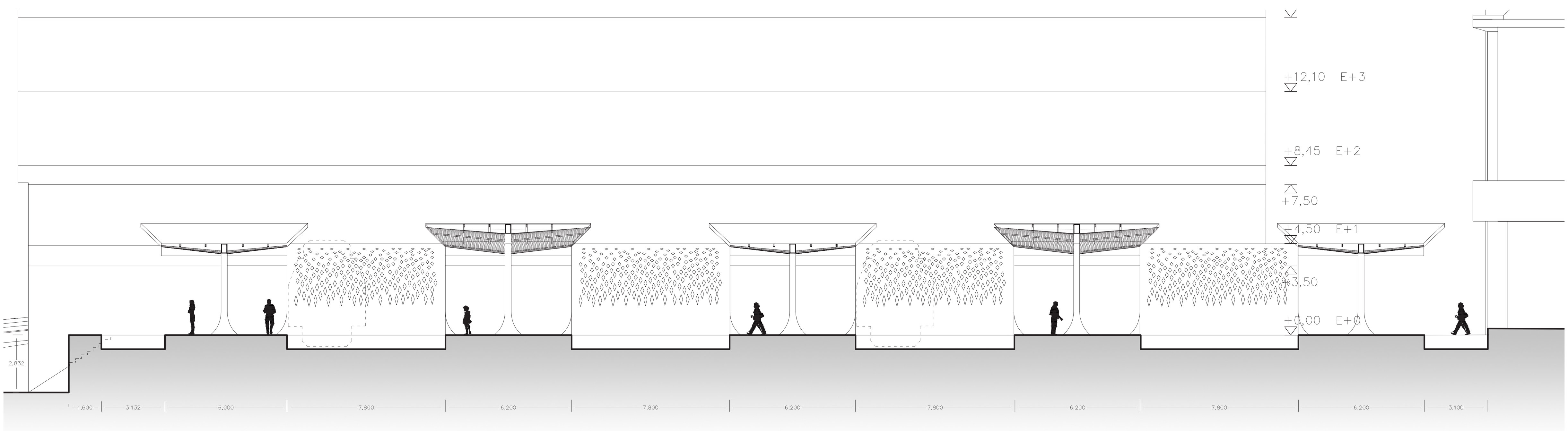
site map 1-5000



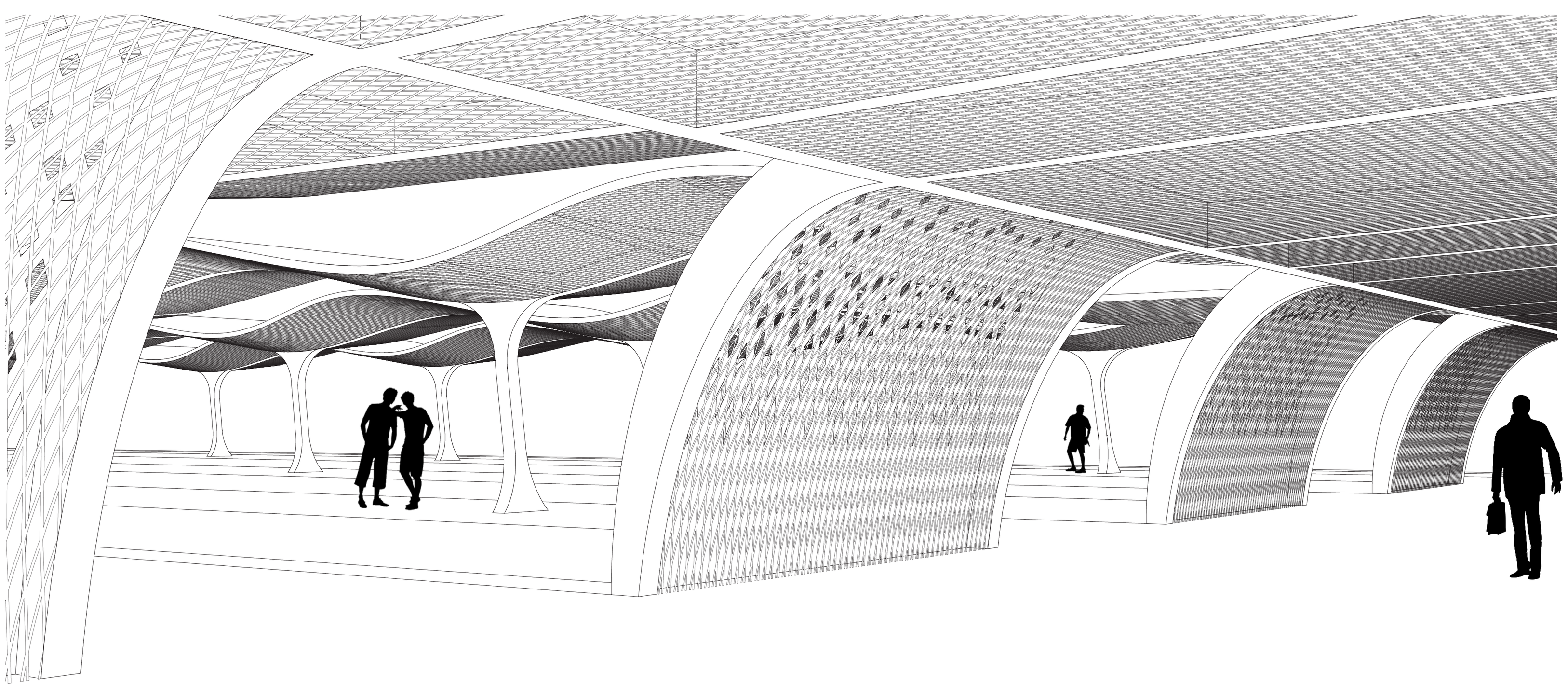

Ground plan 1-500

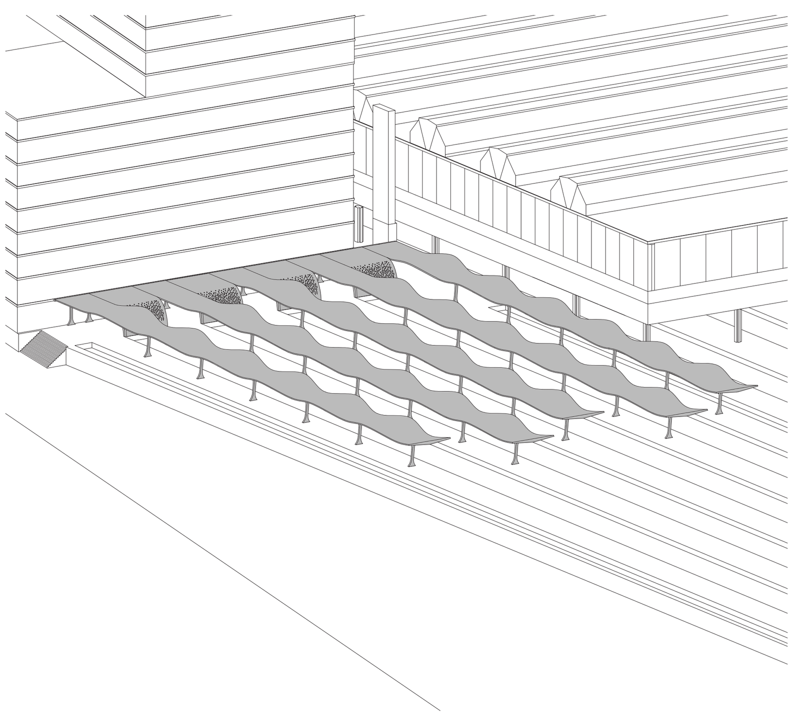


Section B-B 1-500




Section A-A 1-200



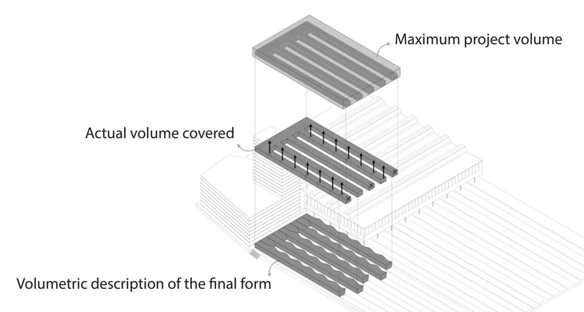


Inner view and Axonometry

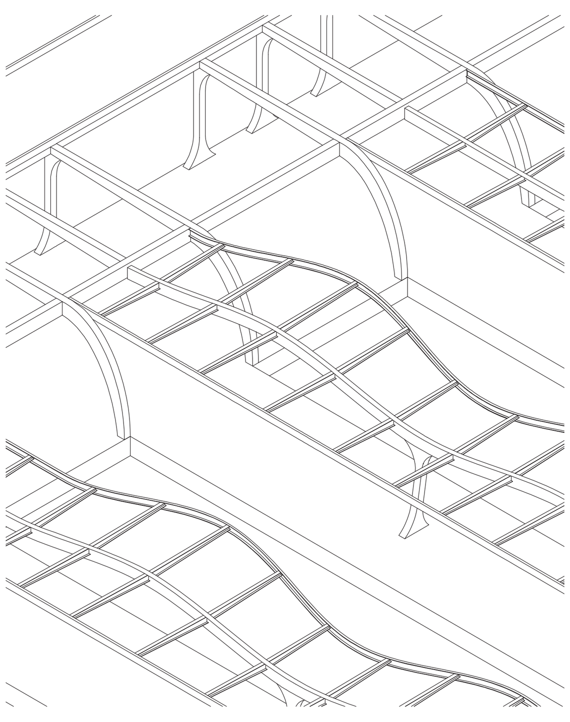
## Concept

The topic of the course was to build a roof on the existing platforms in the area of Starnberger Bahnhof, in the northwest side of Munich Central Station, to be adapted to the new renovation project. Being the area very small compared to this project, the initial idea was to create a structure that would fit well into the context, in order to integrate it into the new station both in terms of form and use of materials. Observing the site, the various criticalities of the area were analyzed, such as the high number of people passing throught and the almost completely glazed building behind the roof, which should not be covered or overloaded with the weight of the new structure. In addition, everything had to be clearly visible from the outside, having as one of the main features an excellent view from Arnulfstrasse.

It is for these reasons that the project, structurally independent from the context, is developed on a minimum height (4.10 m), linking only apparently with the retrostant building at the height of the first, in order to have as a result a simple structure and non-invasive.  It was also very important not to cover the entire area, leaving the train tracks uncovered, in order to allow natural lighting and ventilation, thus avoiding the creation of an unpleasant environment to enjoy. From an aesthetic point of view, the structure has been designed to appear very light, with a sinuous shape that recalls the main roof of the station, kept in the new project as a historical testimony. The roof was thus inspired by the different heights along which the latter develops, softening its features and adapting them to the smallest scale. Moreover it was preferred to filter the tracks of the trains through a cover that folds on itself, thus offering a filtered view. Finally, as far as the materials are concerned, the choice was to maintain a uniform aesthetic connection with the context, mainly made of concrete (old station) and steel (new station), allowing the installation of completely prefabricated elements, easy to assemble and disassemble if necessary, all 100% recyclable. A drainage system is also designed to be incorporated into the roof without changing its design. For this reason, the system's downcomers are placed between the column profile wings and than covered with panels of metal sheet.

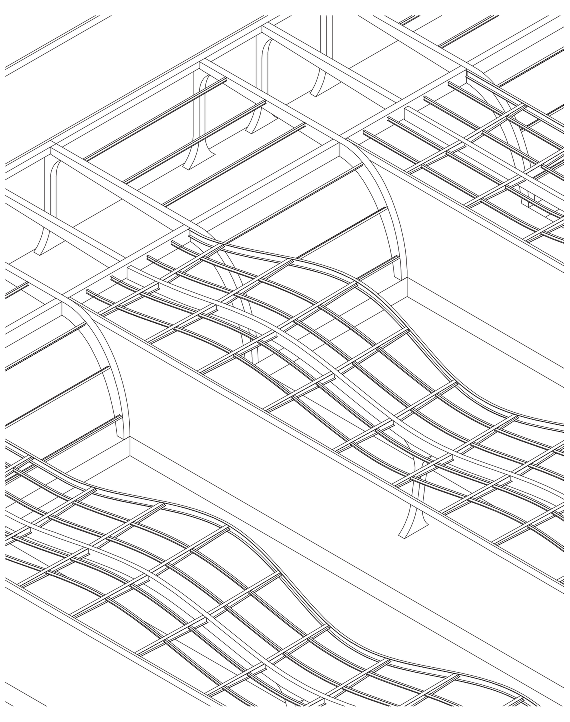



## Constructive process

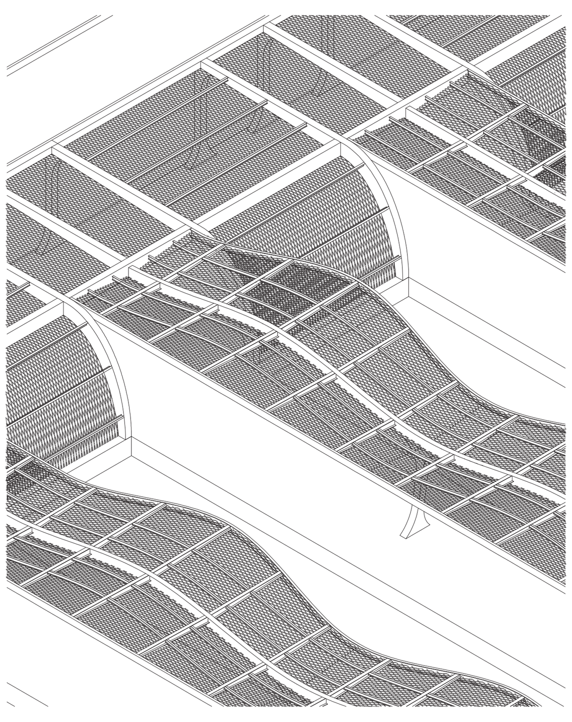


The structure is made up of three fundamental load-bearing elements:

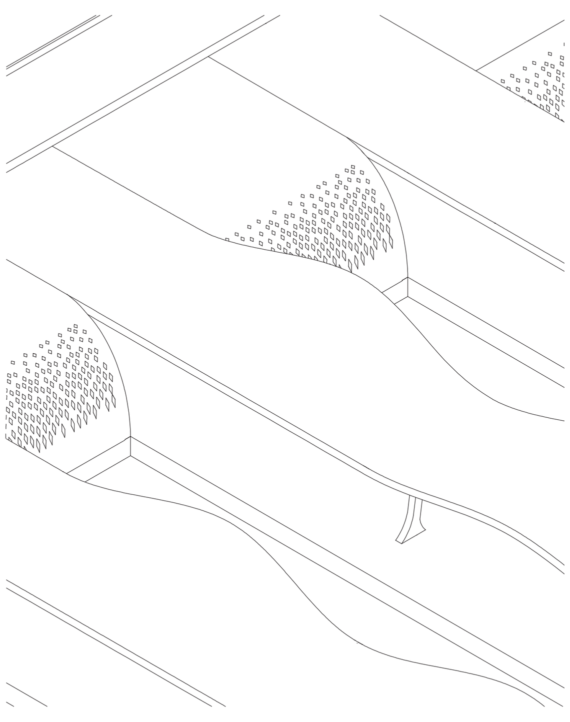
- the HEB pillars
- the hollow beams
- the IPE cantilevers



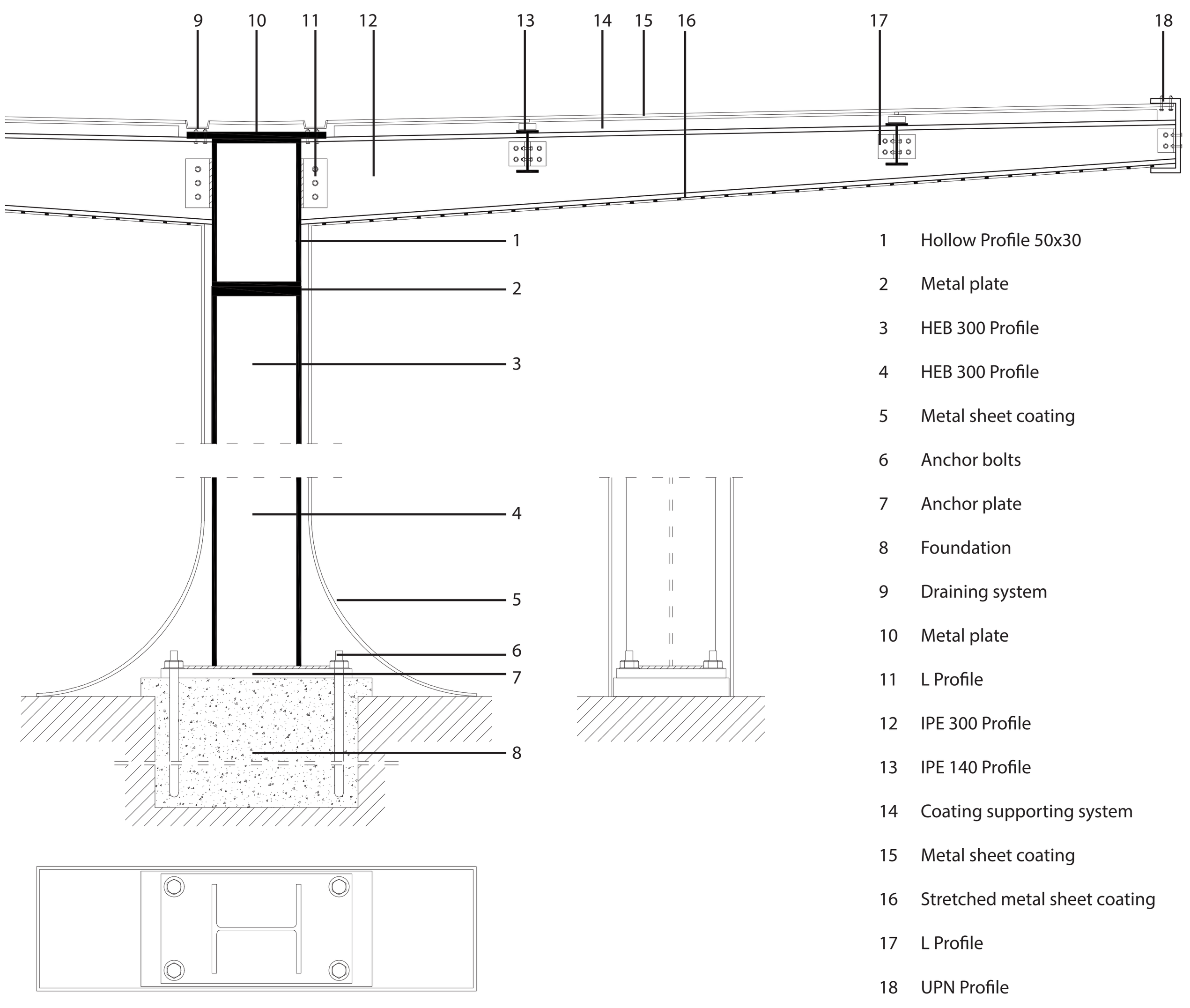
To this basic structure are connected four secondary beams inserted orthogonally to the cantilevers in order to distribute the loads from the roof above. The roof package is completed laterally by an UPN profile that has the double function of edge beam and side closure.



The lower coating, directly anchored to the cantilevers, consists of stretched metal panels that allow to see the structure that they cover. In addition, the short part of the roof partially filters the view of the rails  through the stretched metal sheet inside and the metal sheet outside that is partially perforated.

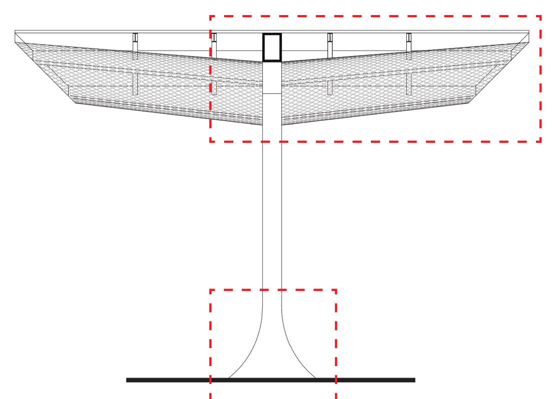


The upper coating is made of metal panels which are anchored to the structure through supports that connect them to the secondary beams. The design that the roof and the columns assume at the end is the results of the expression of the structural behaviour of the supporting structure.

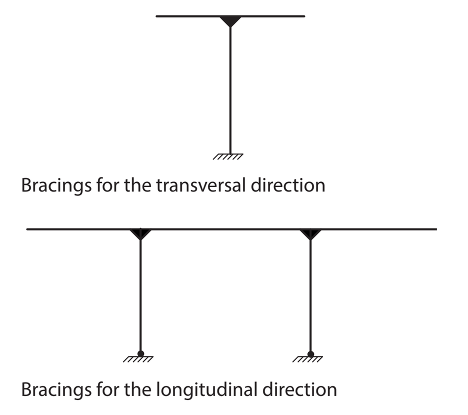



1 Hollow Profile 50x30
2 Metal plate
3 HEB 300 Profile
4 HEB 300 Profile
5 Metal sheet coating
6 Anchor bolts
7 Anchor plate
8 Foundation
9 Draining system
10 Metal plate
11 L Profile
12 IPE 300 Profile
13 IPE 140 Profile
14 Coating supporting system
15 Metal sheet coating
16 Stretched metal sheet coating
17 L Profile
18 UPN Profile

Constructive detail of the top and bottom connection 1-20



Section 1:100




## Dimensioning

About the dimensioning of the structure, we have examined, among the different types of cantilevers present, the one subjected to the greatest structural loads which is of 4.10 m length. It is connected to the main beam and unloads the stresses on the latter, which in turn will transfer them to the pillars and, consequently, to the ground.
Once calculated the maximum moment we proceeded to calculate the modulus of resistance, and than we choose the appropriate profile but increasing the section, recognizing an hypothetically greater effort than that calculated. In addition the attachment points have been stiffened through the use of bracings.

$q = (g \cdot 1{,}35) + (s \cdot 1{,}50) = 4{,}25$ kN/mq

$M = \frac{q \cdot l^2}{2} = 3572$ kN cm

$W = \frac{M}{\sigma} = 163{,}85$ cm$^3$

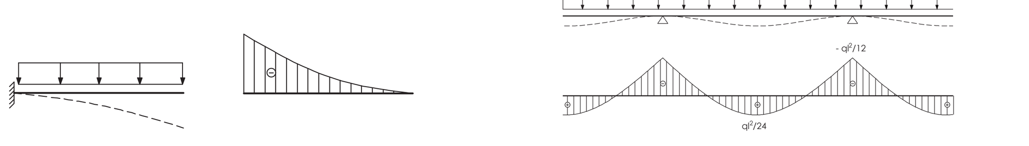
$\geq$ IPE 200

$q = (g \cdot 1{,}35) + (s \cdot 1{,}50) = 10{,}18$ kN/mq

$M = \frac{q \cdot l^2}{2} = 13824$ kN cm

$W = \frac{M}{\sigma} = 840{,}55$ cm$^3$

$\geq$ Hollow  beam 400 x 200




Deformation and moment diagram of the cantilever and the main beam under vertical loads