

Grontmij Staal Partners

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Grontmij | Staal Partners

The consulting engineering firm Grontmij Staal Partners (GSP) operates in mainly two disciplines.

Grontmij Staal Partners Building advises its clients in the field of building science. Project management, the development of drawings, specifications and calculations and monitoring on site are among its services. Clients are private companies, public agencies, architects, housing associations, project management offices and contractors.

Grontmij Staal Partners Consulting Engineers advises its clients in the field of building structures. On the basis of the design ideas of architects, Grontmij Staal Partners designs structures. For architects, Grontmij Staal Partners Consulting Engineers can act as a facilitator to complete their design.

For Grontmij Staal Partners an important principle in the design of building structures is the cooperation with the design team. GSP will support the architectural design and if possible even enhance it. The simultaneous design by architect and engineer in workshops at the start of a project has a positive influence on the outcome of the project.

The mission of Grontmij Staal Partners is: to give 'independent, professional and pleasant' advice to clients in building sector.

Grontmij Staal Partners has 31 employees.



Achmea office, Zwolle

Short Description

A fascinating sea of columns, made of concrete and steel, supports this intriguing building. The outward stepping structure of the high-rise part immediately attracts ones attention. Lightweight composite steel/concrete floors supported by steel beams and columns which cross each other make this, out of the ordinary looking, structure possible. One can immediately understand that complex computer software was used to calculate the forces in the structure of this stylish building.

Project Information

Owner: Achmea
 Architect: LKSVDD
 General Contractor: Salverda - Trebbe
 Engineering Office: Staal Partners Zwolle

Construction Start: 01/02/2006
 Construction End: 27/10/2007
 Location: Zwolle, Netherlands



Introduction

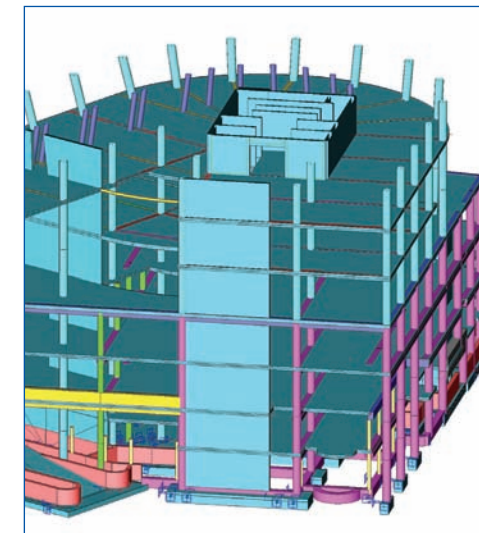
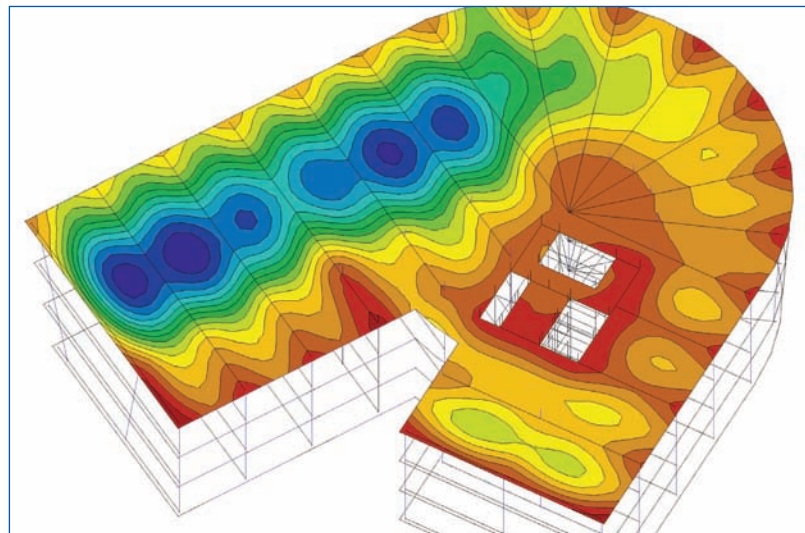
For Groene Land Achmea an office building was constructed to house 1100 employees. The building has 18.000 m² of office space and a 9.000 m² large parking garage that can keep up to 300 vehicles. In total 642.800kg of structural steel and ca. 9.100 m³ of concrete was used. The high-rise part of the building reaches 41,5 m divided over eleven storeys (including a technical installation level). The low-rise part of the building reaches 26,3 m divided over 7 storeys. The bottom four layers of the building contain a parking garage situated over two storeys and two storeys of office space.

Construction

The construction of the building consists of two separate structures: a concrete structure for the skeleton of the middle and lower part of the building and a mainly steel skeleton for the slanted tower.

The concrete skeleton consists of round prefabricated columns and beams supporting a hollow floor with an in situ concrete top.

Horizontal forces on the building are transported via the floors to the lift-shafts. These lift-shafts constructed of prefabricated concrete are situated in the high-rise and low-rise part of the building and ensure stability.



Used software: Scia Engineer

For the round outward slanting high-rise part of the building a lightweight structure consisting of steel columns and beams and composite steel/concrete floors was chosen.

Design

In his preliminary design the architect chose for a floor bearing structure consisting of a beam over three columns. One upright steel column (610 mm dia.) at the right gable and two (middle and left gable) slanting ones towards the outward slanting left gable. This would create enormous horizontal forces on the prefab lift-shafts. The design of the architect was slightly changed by reversing the angle of the middle columns (2 x 406,8 mm dia.). The horizontal forces resulting from the slanted columns neutralise each other largely. The outer column (610 mm dia.) slants 1200 mm outward per 3600 mm storey and by means of iteration a 600 mm slant for the middle columns (2 x 406,8 mm dia.) was determined. This was a logical choice, for the middle column carries approximately twice the load of the outer columns. The structure was modelled in Scia Engineer and an ocean of results became available. To verify the results of the 3D calculation, a 2-dimensional calculation was converted to "3-D", with utmost exertion and many hours of labour, to check the resulting horizontal forces on the prefab lift-shaft. The results came within 5% of each other. Designing this building using Scia Engineer was of enormous value to the project.

Interesting numbers and facts

The torsion moment on the high-rise lift shaft exceeds 39.100kN.m. The bending moment on the high-rise lift shaft exceeds 129.560kN.m in the extreme case. The shear force on the high-rise prefab lift shaft is ca. 4.950kN. The extreme windload on the total structure exceeds 6100kN (610.000kg).

The expected extreme horizontal deformation of the roof will not be greater than 45 mm.

Steel columns with a diameter of 610 mm, a thickness of 12 mm and a length of 25.100 mm were used, as well as columns with a diameter of 406,8 mm, a thickness of 20 mm and a length of 24.150 mm. HEA600 steel beams with a span greater than 13.500 mm were used in the top storey floor.

For the high-rise part of the building no storey has the same size due to the slanting of the left gable and the beams have varying lengths for the eleven storeys.

More than 573 prefab concrete piles make up the foundation of the building.

In the high-rise part of the building it took the contractor 14 days to assemble the structure of one storey and proceed with the erection of the next one.

The building was completed within 20 months.

