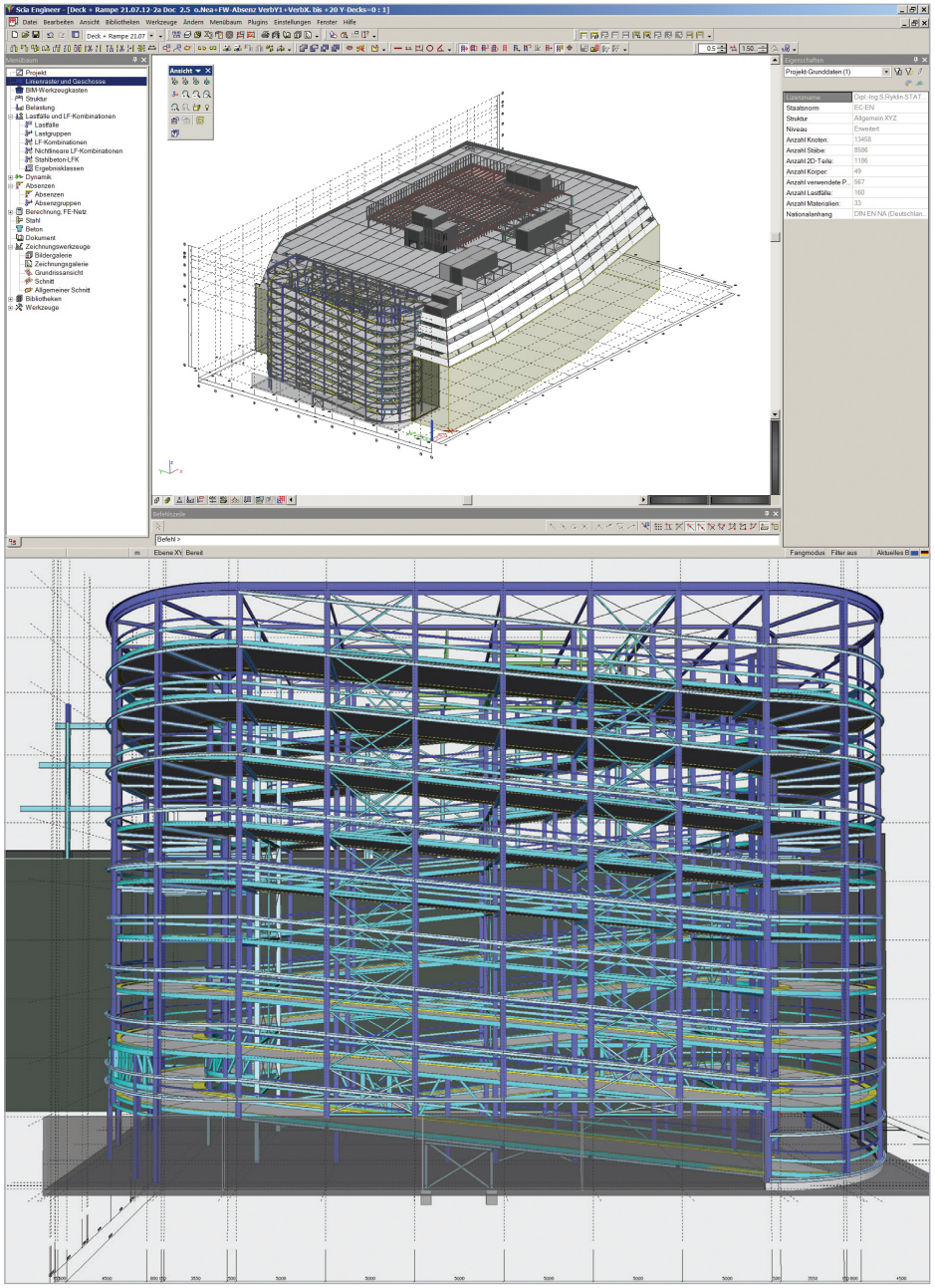
IKEA Roof Parking Space with Side Ramp - Hamburg Altona, Germany



Software: Scia Engineer

Client

The company IKEA is known for its modern architectural designs of various types of appliances and furniture. Founded in Sweden in 1943 by 17-year-old Ingvar Kamprad, the company's name is an acronym comprising the initials of the founder's name (Ingvar Kamprad), the farm where he grew up (Elmtaryd), and his hometown (Agunnaryd, in Småland, South Sweden). As of 2013, IKEA has about 340 stores in 40 countries. Over 130,000 employees work for the company, the 47 German stores employ about 14,500 people. Last year, about 630 million people visited IKEA stores all over the world, about 100 million in Germany alone.

The Order

The first IKEA City Store has to be built on the smallest surface - about 10,000 m^2 - that an IKEA Haus has ever been built. The gross store area covers about 40,000 m^2, distributed over four floors, including the underground floor. Due to the space limit, the required parking space for 730 customer cars is placed on the top of the building at the height between 20.5 m and 31 m. It contains four parking levels. The side ramp structure, about 36 m high, connected the parkdecks with the street. About 3,000 m^2 of steel stage for the building technical equipment sits at the height of 36 m above the decks on the top of the building.

Technical data

The dimensions of the whole building with decks and ramp are about 140 x 85 x 36 m, it has in plan view an unregulated form and the walls of the parkdecks are 60° inclined.
It was divided into two parts for design:

- The main "inside" store building - about 120 x 85 x 21 m (without underground floor) - planned as a prefabricated solid structure (it was handled by the main contractor, Klein and Albert Karlsruhe, directly);
- The "outside" part of the connected parkdecks and ramp - planned as a composite steel/concrete structure with a big steel cage for the building technique above.

Five solid cores of the stairwells and lifts penetrate the decks and are used together with the bracing for the stabilisation of the structure. The main challenge was considering the effects caused by the temperature forces. The park decks and ramp surface were planned as about 26,000 m^2 of Hoesch Additiv Deck, 12 cm high, based on composite beams and steel columns. About 2,100 t of profile steel and 350 t of reinforcement were required.

Software and Model

Scia Engineer was used as the main program for the processing of the whole project. The decks and ramp structure was built up in a 3D model 1:1 according to the architecture planning and boundary of the surfaces, needed for the production of the execution drawing later. Very intensive usage of 3D Raster, Layer, Selection and Material Manager tools was indispensable.
After the required composite beams had been designed with Kretz software, the settled profiles were integrated in the 3D model. The dead structure load at the assembly stage was taken from the beam calculations and assumed as a point load on appropriate columns. The eccentricity of all the planned connections was taken into account. The surface of the decks was considered then as a 12 cm solid plate on steel support beams with reduced density.
The solid cores were rebuilt in the model too so as to consider the effects of the temperature on the "outside" building part and to define the proper bearing on the "inside" structure. It had to be calculated at once. Because of the pliability of the "inside" building structure, the bearing of the decks and ramp was modelled with adjusted springs due to the calculated deformations.

Calculation and production

Linear calculation with absences due to load cases for all beams with small stiffness was processed. The steel support structure was designed according to EC3.
All documents, overviews, elevations, structural details and steel quantities for the production were derived from the 3D model with Document, Picture Gallery and Drawing Gallery tools. Due to reaction forces of the bearing, all connection details to the main building were designed.

Dipl. - Ing. S. Ryklin STATIK

Contact Sergej Ryklin
Address Liselottestrasse 17,
D-69123 Heidelberg, Germany
Phone +49 6221 830973
Email statik@ryklin.de
Website www.ryklin.eu

Sergej Ryklin - Born in 1963 in Moscow
1981-1985: Civil Engineering; "Bridges/Tunnels"; Since 1993: Structural designer and verifier at "Römhild & Hecker" Consulting Engineers in Landau, Germany; Since 1997: Structural designer; 2008-2009: Master's Study at the Institute for Membrane and Shell Technologies, Anhalt University of Applied Sciences, Germany

Range of Capacity: Planning and optimisation of steel, aluminium, solid, composite, timber and membrane structures; Project consultancy; Building physics calculations; Dynamics calculations, Project verification

Philosophy: Flexibility in planning due to integral 3D design with the ability to find feasible and low-cost solutions from the draft stage on.

Experience: Residential and industrial buildings, parking spaces, pedestrian bridges, swimming pools, silos, membranes…

References: Daimler, John Deere, SAP, DB...

Project information

Owner	IKEA GmbH
Architect	nps tchoban voss architekten
General Contractor	Klein + Albert und Partner GmbH
Engineering Office	Dipl. - Ing. S. Ryklin STATIK
Location	Hamburg Altona, Germany
Construction Period	12/2012 to 05/2014

Short description | IKEA Roof Parking Space with Side Ramp

The first IKEA City Store has to be built on the smallest surface - about 10,000 m^2 - that an IKEA Haus has ever been built. The dimensions of the whole building are about 140 x 85 x 36 m. Due to the space limit, the required parking space for 730 customer cars is placed on the top of the building at the height between 20.5 m and 31 m. It contains four parking levels. The side ramp structure, about 36 m high, connected the parkdecks with the street. The "outside" part of the connected together parkdecks and ramp is planned as a composite steel/concrete structure.
Five solid cores from the main building for the stairwells and lifts penetrate the decks and are used, together with the bracing, for the stabilisation of the structure.
The 1.4GB model contains about 8,600 1D elements, 1,200 2D elements, 50 3D objects, 550 cross-sections, 33 materials and 160 loads.
The main challenge was considering the effects caused by the temperature forces.