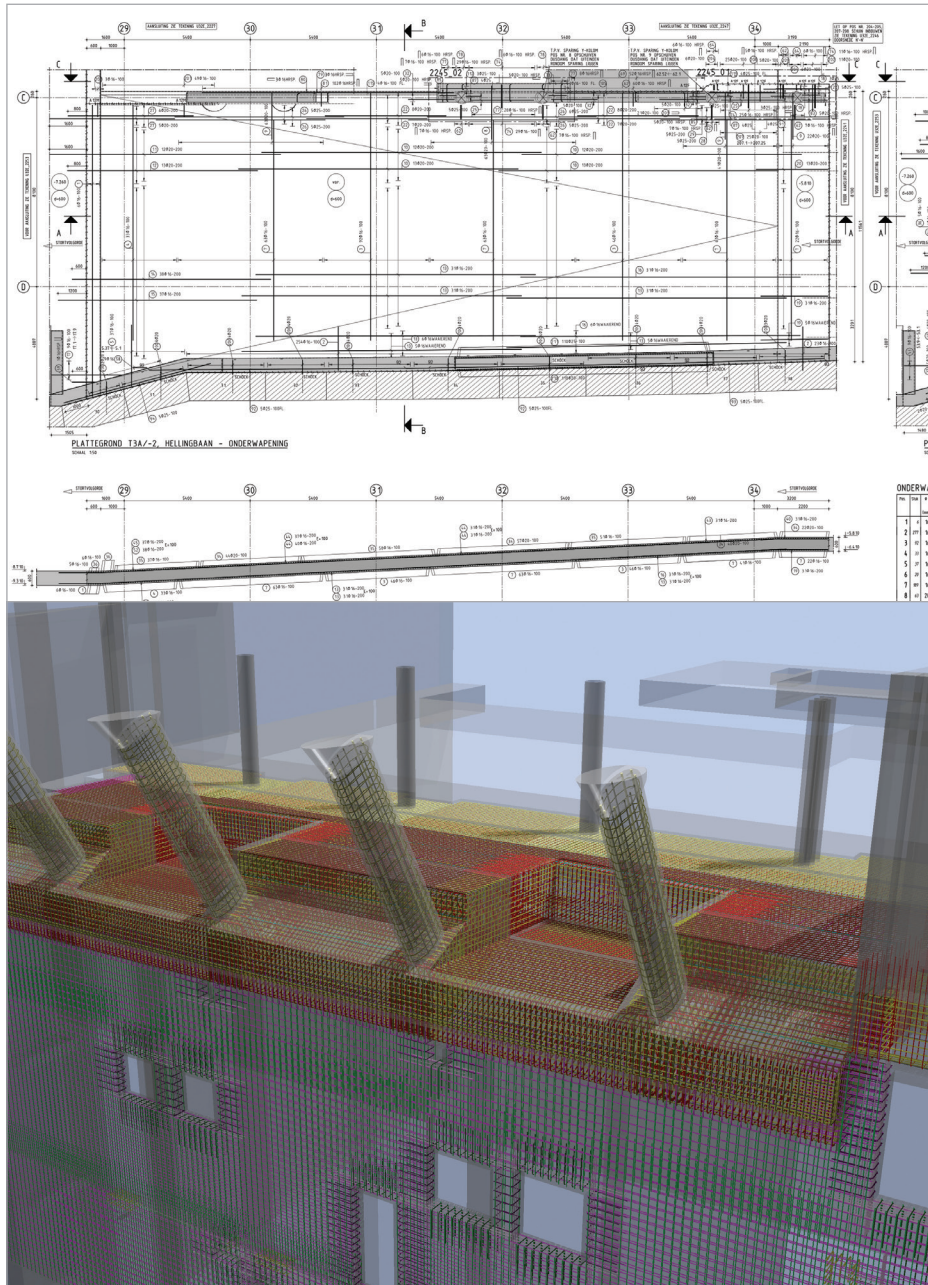


Reinforcement Optimisation Rokin Metro Station North-South Line - Amsterdam, The Netherlands



Rokin station is part of the North-South metro line in Amsterdam, the Netherlands. It is one of three deep underground stations realised to date in the historic city centre of Amsterdam. The project is characterised by difficult soft soil conditions with high ground water tables, very close to vulnerable historic buildings. Therefore the limitation of deformations is the top priority, resulting in a robust design with diaphragm walls and a grout strut in the deep clay layer. The station box Rokin is approximately 200 m long and 25 m wide, with a maximum excavation depth of 26 m. Royal HaskoningDHV, part of "Adviesbureau Noord/Zuidlijn", is responsible for the detailed engineering of Rokin.

Together with our client "Dienst Metro" (Metro Department of the Municipality of Amsterdam) and the contractor Max Bögl we are constantly looking for optimisations within the project. To get a better grip on the interaction between the execution and design, it was decided two years ago to make a 3D model of the station including all the necessary temporary works. In the following process of time and cost optimisation, several changes were made that required the recalculation of several parts of the structure. As a result, existing drawings that were made with regular 2D CAD software had to be changed. However, there were several advantages in using the now available 3D model to make completely new formwork and reinforcement drawings. The 3D model was made in Revit Structure and it was therefore decided to produce the formwork drawings with the same software. To make detailed reinforcement drawings, 3D Allplan was used. Elements from the 3D model were exported to 3D Allplan with the use of IFC files.

As already mentioned, the 3D model enables us to get a better insight into the interaction between the design of the structure, the execution of the work and the temporary works, such as struts and supporting frames. Another advantage is that optimisations in formwork and reinforcement can be revised directly in the model and all corresponding drawings will be automatically changed. Due to the 3-dimensional animation and collision control functions, possible conflicts in areas with high reinforcement quantities are more easily

identified during the design. This increases the quality of the drawings and reduces the amount of problems during execution. The more realistic overview of the reinforcement thereby helps to design the necessary support reinforcement that is also included on the drawings. The direct availability of the bar bending schedules on the drawings increases the work speed for the contractor.

3D Allplan enables us to draw complicated reinforcement lay-outs with the help of intelligent functions within the program. Besides existing functionalities, some other methods are used to speed up the process. When possible, due to repetition in the structure, reinforcement is copied. The model is set up in coordinates and therefore the labels and dimension lines are lost when an element is copied and moved. As labeling is a relatively time-consuming activity in the process of making a reinforcement drawing, this is a disadvantage. Royal HaskoningDHV developed a "trick" that made it possible to copy and move an element without the loss of the labels and dimension lines (see [1]).

The 3D model also creates a solid base for the as-built drawings that have to be made in the near future. Deviations during execution can be adjusted directly in the model. This enables, for example, the use of the model for the technical installations design in an early stage.

To date, approximately 70% of the drawings have been delivered to the satisfaction of both the client and the contractor. The use of 3D Allplan enables us to implement optimisations in a short period of time. The aforementioned advantages contribute to a more efficient execution of the work and thereby help in realising earlier project completion.

[1] Van Baal, M. - "Verschuiven met behoud van wapeningsmaatvoering en -labels" - CAD Magazine 2013-01

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Royal HaskoningDHV is a leading independent, international engineering consultancy service provider with roots established in the Netherlands, the United Kingdom and South Africa. We specialise in aviation, buildings, industry, energy and mining, infrastructure, maritime and waterways, planning and strategy, rivers, deltas and coasts, transport and asset management, and water technology. A first choice consultancy for major world challenges, our experts provide sustainable and pragmatic solutions.

Working together, we can achieve more. This is the philosophy we embrace at Royal HaskoningDHV. With the overarching aim of enhancing society together, we work closely with clients, stakeholders, industry, and academic leaders, to ensure projects are delivered on time and within budget, while providing a better, brighter, sustainable future. Royal HaskoningDHV is part of "Adviesbureau Noord/Zuidlijn".

Project information

Owner	Dienst Metro (Metro Department Municipality of Amsterdam)
Architect	Bentham Crouwel Architects
General Contractor	Max Bögl
Engineering Office	Royal HaskoningDHV
Location	Amsterdam, The Netherlands
Construction Period	2002 to 2017

Short description | Reinforcement Optimisation Rokin Metro Station

Royal HaskoningDHV is responsible for the detailed engineering of Rokin station. A 3D model of the station is made, which includes all temporary works. In order to make detailed reinforcement drawings, elements from the model are exported to 3D Allplan. The realistic 3D overview increases the quality of the reinforcement drawings, thus reducing the error rate. Whenever possible, intelligent copy and move tricks are used. Bar bending schedules, including support reinforcement, are directly available to the contractor. In general, the use of 3D Allplan contributes to a more efficient execution of the project.

