

DRIVEN BY BETTER DESIGN

Dutch engineers are taking advantage of geospatial data to enhance use of Building Information Modelling in creating and communicating a detailed blueprint for the new A4 motorway. **NCE** reports.

Geospatial data can be used to significant advantage in construction and infrastructure projects, particularly when design concepts are being developed, where it can enhance understanding of existing social, physical and geographic factors and their potential impact on the build.

That is certainly the case in the Netherlands, where the A4ALL joint venture building the A4 Delft-Schiedam motorway has married BIM functionality with geospatial data to create a detailed design blueprint for the €298M (£242M) infrastructure project. A4ALL is a joint venture of Dutch contractors Boskalis, Heijmans and VolkerWessels, and is carrying out the work for the directorate-general for Public Works and Water Management (Rijkswaterstaat).

Work on the A4 Delft-Schiedam began in April 2012 and is scheduled for completion in 2015. Once finished, the 7km stretch will be a valuable part of the road system linking The Hague and Rotterdam, and significantly reduce congestion on existing routes. It will also strengthen the road network by providing an alternative route in the event of an accident or road works. Estimates suggest that, on an average working day, 128,000 cars will use the new road.

But it is far from simple. The 7km route includes a 2km long tunnel and also features an aqueduct and "ecoduct" to improve the quality of green areas through the construction of 100ha of nature areas, viaducts,

bicycle and walking paths and sustainable agriculture. Amongst a range of other technical considerations, engineers had to factor in the rebuild of a major intersection and the installation of new covering layers on three existing roads along the route.

With that in mind, BIM was seen as key.

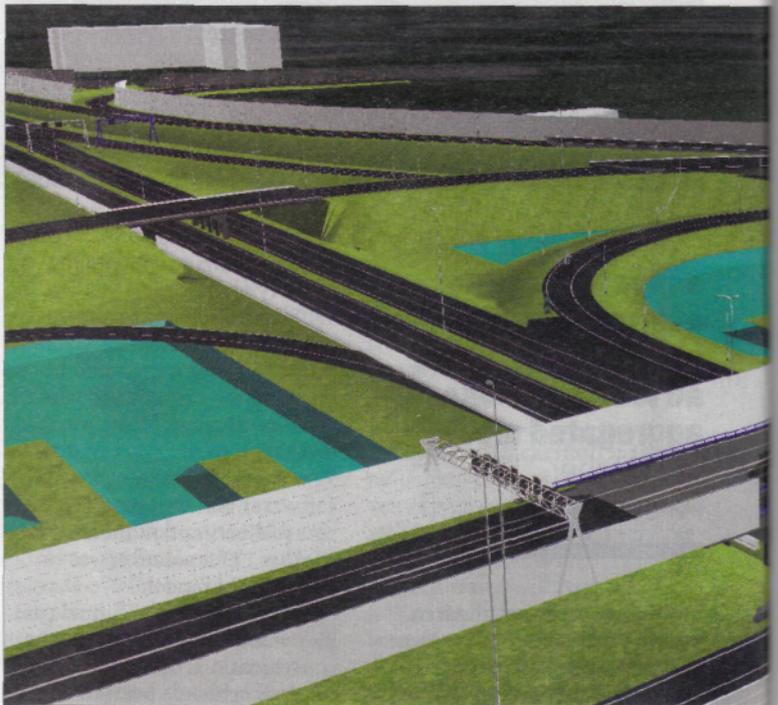
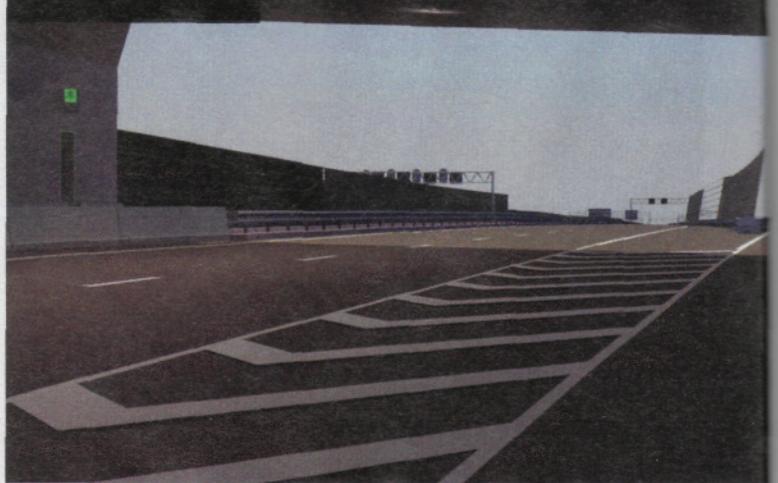
"There were three guiding principles for the A4 project – safe, quick and precise," explains Cristian Otter, BIM advisor at Heijmans. "Safety centred on our No Injuries, No Accidents (NINA) policy as well as ensuring the road, tunnels and recreational areas were all safe for future road users.

"Speed was important to minimise the impact and disruption to residents in the surrounding area while precise meant the use of the latest civil engineering techniques combined with the use of cutting-edge software tools," says Otter.

"At the preliminary bidding stage we discussed the various project disciplines, work processes and software usage," adds VolkerWessels senior designer Jeroen Tishauser. "For each process we determined, a short manual was created to assist the technical users and the engineers that judged the models and drawings," he explains. "The Autodesk Design Review mobile app was very useful here as it allowed us to comment on the drawings and reference the notes again at a later stage," he adds.

Following the comprehensive planning sessions, the contracting team linked the plans it had created in the

Transparency: Creating a 3D visualization of the highway before anything is built helps to communicate with all stakeholders, including the public, what the finished product will look like



"The fact that we could actually demonstrate that the construction would minimise the environmental impact on wildlife or the local residents, for example, was a huge advantage"

Cristian Otter

project management software, Primavera, to an Autodesk Navisworks model. Each object contained in the model, from the larger civil structures to the smaller sub-objects, was given a unique name so that they could easily be searched for and extracted. This approach also enabled users to easily reference all the associated documents for each object by clicking on a link from within the Navisworks model.

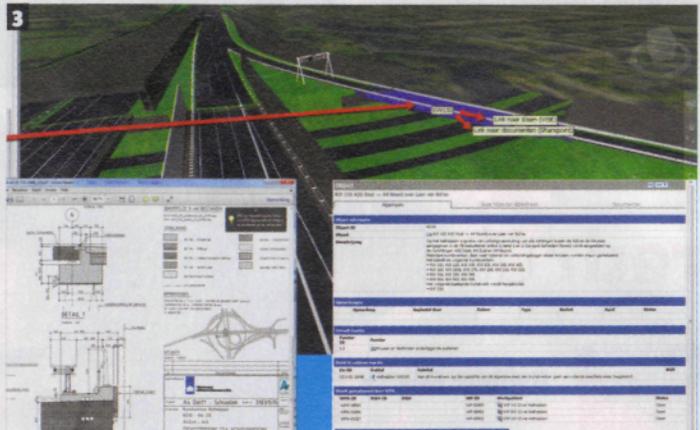
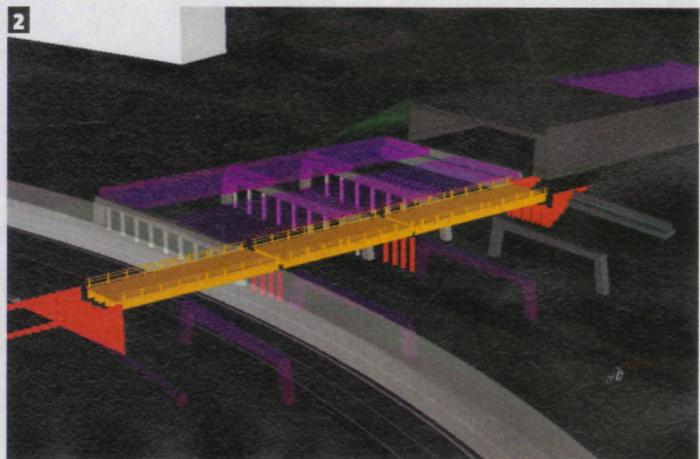
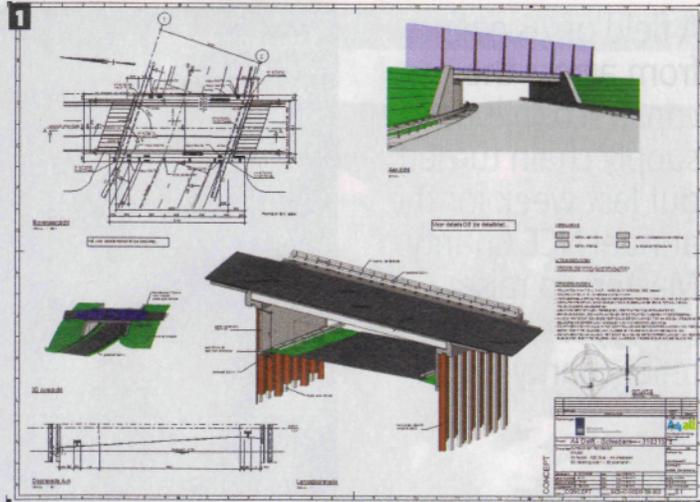
Using BIM methodology, A4ALL optimised input and output processes using standard,

Right and below right:

- 1 A section of highway is analysed using Autodesk BIM for Infrastructure software
- 2 Being able to accurately visualise new structures on top of existing highway ensures efficient design
- 3 From within Autodesk Navisworks, designers can easily access database information and document requirements with a simple click



Clear paths: Visualizing on-ramps and loops in 3D using Autodesk BIM solutions ensure that there are no obstructions or errors in placement



off-the-shelf functionality contained in Autodesk infrastructure software solutions. The model was then used to communicate the plans to technical and non-technical stakeholders. "We were able to show external partners when and why something was being constructed, as well as explain exactly what it was," says Otter. "The fact that we could actually demonstrate that the construction would minimise the environmental impact on wildlife or the local residents, for example, was a huge advantage."

Working within the model,

A4ALL used 3DS Max Design visualisation software with Civil View extension to analyse and assess detailed considerations such as sun reflection when exiting the tunnel and sound barrier locations at the tunnel exit. "We were able to convince our client of our solution by addressing the problem from a car-viewpoint," adds Tishauser. "These same issues would never have surfaced this early in the 2D design process."

Many of the existing bridges on the route were located at a busy interchange built in the

1950s and 1960s. The original design drawings of the interchange dated back half a century and were not accurate enough for the teams to use to create the intelligent model. To gather the data they needed, the team mounted a mobile laser scanner on a vehicle and then combined the laser data with surveyed control points to create an accurate point cloud for each bridge. "Using the new Revit functionality to index point clouds, we were able to accurately model the existing bridges very early in the design project," says Otter.

In addition to price, the quality of the build was of great importance to Rijkswaterstaat in commissioning the road. The fact that A4ALL was able to digitally explore the project's physical and functional characteristics at the design stage and clearly communicate its vision at a detailed level was a great advantage in securing the project.

Now the work has begun, the BIM methodology and model-based approach will be deployed throughout the project lifecycle to help make better, more informed decisions.