

A NEW LANGUAGE IS BORN

PATRICK MCGLOIN

Director General

ViaNova IT AS

Sandvika - Noruega

www.vianovasystems.com

All professions have developed their own language. A professional language is mainly used to ensure clear communication within the profession but also has been used to mystify and ensure status. Doctors, lawyers, scientist and yes Civil Engineers have developed a communication that is specific to their particular area. This worked well as long as the necessity to communicate was limited to the profession or the chosen few that needed to interact. Today this is no longer good enough. Our society has become more and more complex and the requirements to a design process have increased enormously. Many people and groups inside and outside the design teams have a right and need to understand what is happening and what the result will be. This applies to both large and small engineering projects. Without a language that is easily understood the risk increases that “bad” decisions are made, and also opens for design mistakes.

A middle size-engineering project be it a new road, a new rail line or an urban renewal project is a long process including the assessment of many alternatives. It can also include environmental impact studies and changes or improvements to utilities. It always enjoys a high media profile both positive and negative but often negative with interest groups all trying to influence the result. The role of the design group is to present the various alternatives in a professional way giving the decision makers the best possible basis to chose the best solution. A bad decision has a life span from 30 to 100 years. A bad decision is a much a defeat for a design team as a design mistake or a cost overrun.

A modern design tool now works more and more with 3D digital data. Not only for the terrain model but more and more will all the elements of the design. This now gives the basis for rapid and cheap 3D visualisation during the design process and in the presentation phase. There is now no reason why decision makers should not demand 3D and Virtual Reality of the projects they should approve. Whether it is an intersection improvement or a major urban renewal project both within the design team and for the decision makers Virtual Reality is now a viable option.

In many countries in Europe it is proving difficult to recruit students to Civil Engineering courses. The advances in design tools with Virtual reality interfaces is an important development towards making these studies more interesting and exciting.



Project example 1: The Bjørvika project

Over the last 15 years the Norwegian Road Administration and Oslo municipality have been working to relocate the large traffic volumes created by the E18 highway from the streets of Oslo. A number of tunnels have already been built. The main challenge remaining is the Bjørvika/Bispevika area south for the main station. Today the E18 highway acts as a barrier between the city centre and the Oslo fjord. In addition this area has been selected as the site for the new national Opera House (designed by the international renowned Norwegian architect Snøhetta). The municipality has designed this area for a large urban renewal and the existing port facilities will be moved to a new location.

Today the area suffers from the densest traffic in Norway, with an annual daily traffic of 110,000 vehicles. At present, this traffic, together with the port activity, characterizes the area. In the future, however, with a fully developed new road system and the port moved from the area, Bjørvika will once again become a residential and commercial district with full access to the fjord.

Stage 1 of the project places the E18 in a submerged tunnel (the first in Norway), providing 2 3-lane carriageways underneath the seabed. A new intersection will be built close to the Havnelageret building and the Sørenga site, providing exits to the Oslo city centre, Oslo Central Station, National Route 4 towards the north and the E18 towards the south. The estimated cost of Stage 1 is in the vicinity of NOK 2.4 billion. (300 million €)

When stage 1 has been completed, the existing 2 plan intersection at Bispelokket will be demolished and the new street structure established (stage 2). Plans for the development of the area include a mixture of housing, offices and businesses. A school, hotel, museum space and marina are also included.

This is a complex project requiring many political and engineering decisions. From the early stages a 3D model of this area of Oslo has been created and constantly updated with the 100's of alternatives by ViaNova both with regard to the road infrastructure but also with regard to the new development proposed for the area.



The mayor of Oslo called the digital 3D model that was used during the whole Bjørvika design process the new democracy. The municipal politicians were able to follow the process including a massive restructuring of the road infrastructure, the building of a new Opera House and addition of a whole new residential area replacing the existing port.

The 3D model

Great emphasis was placed on an open process in the planning work, not least to ensure good understanding and communication of the planning proposal externally. For this reason, the Client used 3D presentations in various media. This proved to be great help during the planning work itself and in connection with the planning process/presentations.

Several different programs were used for the establishment of the digital 3D model of the existing situation. The main model was put together in 3DStudio but Novapoint was used to triangulate the terrain that covers the entire Oslo area, and Novapoint Virtual Reality was used to generate existing buildings from the information contained in the digital map.

The new district

The new district was modelled in a process of close collaboration with the Planning and Building Department of the Municipality of Oslo, and was included in the large 3D model. The data was partially received from external sources (various architects) and partially modelled directly from sketches and input from the client. In addition, the model was complemented with various details such as horticulture, various surface details, people, etc. in order to create the correct expressions and quality in the various plan areas.



Areas of use and medium

The model was used actively during the whole of the planning process, and proved to be very useful when seeing what the various suggestions looked like from various parts of the city. One of the advantages with a digital model is that it is easy to go to the locations where you want to place your camera point, and then "make snapshots" from them. Amongst others, the discussion around high-rise buildings led to the model being used very actively, and the model contained exact geometrical alignment data at all times. The models were also used for various sun/shadow studies, which are easy to establish using the digital model.

Many pictures from different positions were made for use in the plan description, plan presentations, basis for discussions with various involved parties, the media, the Internet, etc.

Both panorama views, i.e. pictures generated from fixed points that allow a 360 degree scan, and animations from both ground level and from the air, as well as DVD presentations were made for use in an Information Centre. The main aim was to communicate the plans as well as possible to the general public, the various local parties and decision makers.

During this comprehensive planning process these 3D presentations have been necessary as supplementary information to the regulatory plan and will be actively used in the future in the planning process.





The project is now in the construction planning stage and the model, particularly of the submerged tunnel is being used to make engineering decisions with regard to tunnel geometry, placement of fittings such as fans, traffic signs and emergency equipment. In addition the model has been used to design the lighting type and placement. The tunnel itself will be prefabricated, floated into place and sunk into its final location. It is extremely that account is taken of all factors that will effect the geometry early in the design phase.

Project example 2: The Svinesund bridge

In connection with the design and constructing of a new motorway (E6) between Svingenskogen in Norway and Nordby in Sweden a 3D digital model has been created for the entire corridor. The model covers an area of over 200 sq. kilometres and includes the existing and new Svinesund bridges over the Iddefjord. The model was produced directly from engineering design data taken from the Novapoint design system.

Co-operation across borders

As the corridor of the new E6 crosses the international borders of Norway and Sweden, companies from both countries were involved in creating the 3D model. The group consisted of FB Engineering AB and AEC AB, from Sweden and ViaNova Plan and Traffic AS, ViaNova Systems AS and Dr. Eng. A. Aas Jakobsen AS, from Norway.

The 3D model was created using the software package 3D Studio. The road geometry was designed using Novapoint Road Professional and all constructions were modelled using Novapoint Bridge. Traffic signs and plates were designed in Novapoint Traffic Signs.

Data source

One of the aims of the model was to see how the new E6 alignment would fit into the scenic landscape each side of the border, its relationship to the existing E6 and to assess the new Svinesund Bridge. Digital maps from the Halden municipality and from the Swedish authorities were obtained - covering a total area of approximately 200 sq. kilometres. In addition detailed terrain models, obtained from the Public Roads Administration Østfold and from FB Engineering AB, covering the motorway corridor were added to the data from the digital maps to create a common 3D terrain model for the whole corridor. In order to obtain enhanced graphical views, especially at horizons, orthophotos of the terrain surfaces were obtained and draped onto the terrain model. In the areas where orthophotos did not exist, satellite photos were used, which are similar images but having lower resolution. It was important to include the existing Svinesund Bridge in the model and it was modelled on the basis of construction drawings.

Modelling a new E6

One of the goals of the 3D model was to give an accurate representation of the driving experience on the new road in both directions. Both sections of the new E6 had been designed in Novapoint and the Novapoint Road model was automatically added to the terrain model. The complete 3D model with terrain and roads was then imported into 3D Studio and textures were applied to the various surfaces. The various construction elements like retaining walls, culverts and particularly the new Svinesund bridge were modelled in Novapoint Bridge. 3D models of the various structures are produced automatically based on the road geometry and added to the 3D Studio model. All construction elements were modelled based on the actual construction drawings.

Objects like fences, guard-rails, traffic signs, road lighting, etc were added. To persevere the accuracy of the model object locations were taken directly from the construction drawings. Traffic signs were taken directly from Novapoint Traffic Sign and road markings from Novapoint Road Marking. In addition, special buildings such as a new customs station on the Swedish side were given particular attention and modelled to a detailed level.

Novapoint has always been based on a 3D model. The improvements in Virtual Reality technology now means that a designer can see his project right through the design phase in a VR window. With the addition of Novapoint Virtual Map a design project and all its elements can inside a few hours be presented as a high end virtual model. Changes can be viewed almost instantly.

Summary

The Virtual Reality and 3D possibilities that are now available allow civil engineering information to be accurately combined with existing situations giving officials, politicians, the general public and other interested bodies a more active role in the decision making process. For us designers this gives us a whole new window both to work in and to communicate with. It is both fun and gives us a new way to quality control the work we do. It also allows the various professionals that must work together on complex civil projects to interact in a much better way.