



The television and radio transmitter mast in Hoogersmilde provides coverage in the northern part of the Netherlands. After its failure in 2011 due to a blaze, Iv-Consult contributed to the design process for the new mast using Scia Engineer as FE software.

This project was carried out to a very tight schedule and in close cooperation with client Omroepmasten B.V. and contractor VolkerWessels Telecom, and together with Iv-Bouw. This joint effort resulted in a new design and appearance for the Hoogersmilde antenna mast.

Description of the structure

The original tubular section with a diameter of two metres has been replaced in the new project by an open lattice structure in a triangular section. The steel lattice mast is built above the existing concrete tower, starting from the level +80 m and reaching the height of 303 m.

The three CHS 244.5 x 25 vertical columns running from the bottom to the top of the shaft are braced alternately every 2,000 mm by diagonals CHS 114.3 x 5.0 lying in the three sides of the shaft. The base of the mast consists of a nine metre high pyramidal module aimed at conveying the forces from the three vertical chords to the rocker bearing at the top of the concrete tower. The lateral support is provided by three groups of pre-tensioned cables which connect, at four levels, the shaft to the anchor blocks on the ground. Subdividing the plane in three angles of 120°, the cables departing from each of the three corners of the triangular section restrain the shaft against the wind forces in every direction.

The erection of the mast was completed in two weeks by a specialised helicopter installation company. Special tools and procedures were designed by VolkerWessels to ensure the success of the delicate operation, which included the installation of more than fifty modules and the guy wires that were flown into position and hooked up in special devices. Feeder cables were finally installed to provide transmitting signals to the antennas fixed to the shaft. Ladders and platforms were installed for service and maintenance purposes.

Design with Scia Engineer

Guy-wired masts are a relatively slender and fragile type of structure since they only need to provide height

and resist wind. Nevertheless, guy-wired masts of this scale are classified by code as one of the most complex structures in structural engineering. Due to its national importance, the mast was designed for consequence class 3 in accordance with Eurocodes. This requirement, together with the tight deadline of only a few months from design to the start of the fabrication, made the analysis of the structure a real challenge.

In order to allow for the high displacements of the structure, a geometrically nonlinear analysis was performed and Scia Engineer proved to be a useful tool for this purpose.

The model consists of approximately 700 elements. The “cable nonlinearity” and the “initial pre-stress” functionalities offered by the software have been used to accurately represent the behaviour of the guys. With the use of specific modules, wind and ice loads have been applied to all the guy wires and all structural members. Wind, ice and permanent loads have been combined in several nonlinear combinations and the governing results were determined using the results classes. To control and analyse the enormous amount of results, the “active document” feature was used, allowing for an overview of the results, updated whenever necessary.

The resistance and stability check of the members composing the structure has been assessed by means of a Scia Engineer module which incorporates the provisions of EN1993-1-3.

The flexibility in the arrangement of the results as well as the several exporting options were beneficial in order to determine the effects related to the event of a rupture of one of the guys. For this purpose multiple analyses on different copies of the model were carried out according to the “conservative procedure” and the “simplified analytical model” (EN1993-3-1).

A modal analysis has moreover been executed to determine the natural frequencies of the structure. The software allows the user to easily transform the applied loads in the correspondent mass attributes which are used as input by the dynamic solver. With the knowledge of the eigenmodes of the structure, its sensibility to the wind frequencies can be evaluated.

Contact W.M. Visser
Address Noordhoek 37
 3351 LD Papendrecht, The Netherlands
Phone +31 78-6448555
Email w.m.visser@iv-consult.nl
Website www.iv-consult.nl



Iv-Consult is a division of Iv-Groep, a group of professional engineering companies. Through the years, the company has developed itself into a highly qualified engineering company and sparring partner for clients who need independent advice or a constructive solution.

Services are provided from preliminary design up to detail design. Iv-Consult is a market leader for the design of steel and mechanical structures. The main office is located in Papendrecht, the Netherlands. Iv-Consult also has offices in Almere, the Netherlands and Kuala Lumpur, Malaysia.

As an engineering company, Iv-Consult focuses on the challenging design and engineering of complex structural and mechanical projects. The company has the know-how and experience to realise large-scale projects like power plants, ports and yard developments. Our clients can vary from end-users to developers, architects and contractors. We provide engineering services with a creative mind setting and a high focus on cost effective design. Quality through cooperation is our selling point.

Project information

Owner	Omroepmasten B.V.
Architect	Omroepmasten B.V.
General Contractor	VolkerWessels Telecom
Engineering Office	Iv-Consult
Location	Hoogersmilde, The Netherlands
Construction Period	01/2012 to 09/2012

Short description | **New Antenna Mast Smilde**

On 15 July, 2011 a blaze in one of the feeder cables caused the Hoogersmilde guy-wired antenna mast to collapse, causing service disruption to the region and damage to part of the concrete tower. The goal of the client Omroepmasten B.V. was to minimise the disruption by installing a new mast on the concrete tower by August 2012. To mitigate the tight deadline, Iv-Consult and contractor VolkerWessels Telecom completed a parallel fast-track design that would meet the scheduled mast erection date. Scia Engineer was deployed to carry out the analysis of the new guy-wired lattice mast. A geometrically nonlinear analysis of the structure was chosen in order to allow for the high slenderness of the structure and to better represent the behaviour of the cables. A modal analysis has moreover been executed to evaluate the natural frequencies in comparison with the wind actions.

