Building sustainable school *the Dutch way*

An artist's impression of the Christiaan Huygens College. Highlight of the building is the Energy Roof, which allows it to generate surplus energy that can be used to heat the adjoining sports hall and nearby apartments. The building also features three distinctive rings, which reflect its interior of three sections where the functions are concentrated such as sanitary facilities and terminals. © RAU

The Christiaan Huygens College, currently under construction in Eindhoven, the Netherlands, is set to be the first CO_2-neutral school in the country. When completed at the end of the year, it is expected to reduce carbon dioxide emission by 98.5 percent and estimated to save €130,000 annually on energy costs.

Designed by RAU, the project is a collaborative effort between several organisations including the school, the community, architects, contractors, engineers, consultants and the government agency, NL Agency (formerly known as Senter Novem). The agency provides subsidies and grants to specific projects that meet the criteria of sustainability, innovation and exceptional co-operation between organisations. It has given a grant of nearly €800,000 to the project.

The Christiaan Huygens College has a gross floor area of 7,800 sq m and will house about 850 students ranging between 12 and 17 years old.

Above and left: Well-insulated windows allow natural daylight to help light the building without causing it to overheat. Photos © RAU

The project broke ground in August 2009. Phase one involves construction of the school building, which commenced in November 2009. Carried out by contractor Heijmans Utiliteitsbouw BV, work comprises drilling piles and pouring in the foundations, and lying the pipeline for the water and sewage system as well as for the heating and cooling system. It also includes installing the insulation, reinforcement and underfloor heating system for the building.

By December 2009, foundation for the basement and three columns for the three-core structure of the building have been completed. In February 2010, the second floor (top floor) of the building began to take shape.

However, harsh weather posed a challenge for the project team. The temperature dropped to below 5 deg C during winter 2009 and it yielded a lot more ice and snow than ever before. As a result, work was put to stop for a while. It was resumed in the second week of February 2010 when the temperature had risen to above 5 deg C.

Phase two of the project involves construction of the 3,800 sq m sports hall,

Groundwork in early November 2009, before construction of the school building commenced.

located next to the school. It will be built using the existing materials from the old building that had been demolished, making it highly sustainable. Work is scheduled to start in July 2010 and be completed in 2012.

The design and construction of the sports hall was awarded to Dutch architect and construction consultants, Liag. The building will consist of three gym areas, where students can play sports and exercise during their gym lessons on the weekdays. At night and over the weekend, it will be used for sports team training sessions and a venue for sports meets and tournaments.

A sports field, Botenlaan, will also be built next to the sports hall.

Compact construction design

The school applies a compact construction design to limit the surface area of the facade. The round shapes of the building provide a

Top: Concrete pouring on the ground level of the school building. By end of 2009, foundation for the basement and three columns for the three-core structure of the building have been completed.

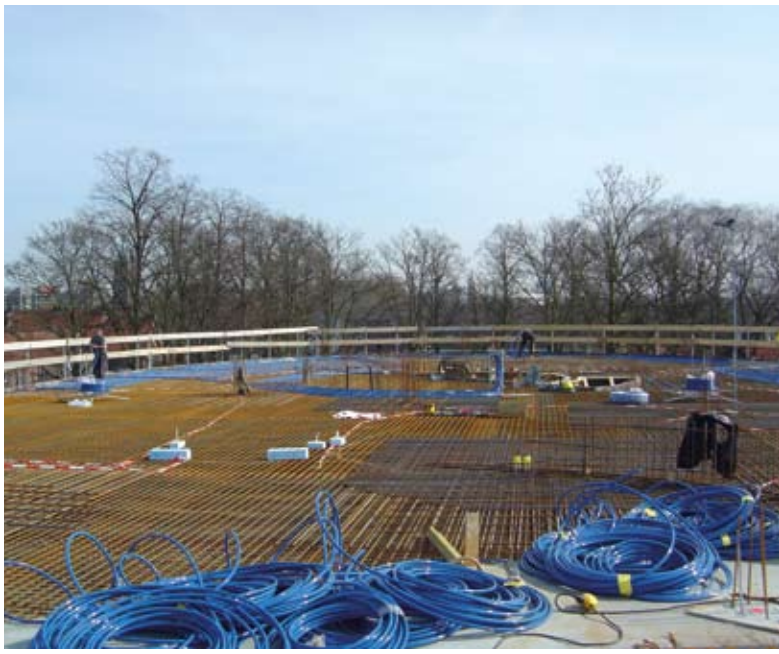
Above: The top floor (second floor) of the building being prepared for concrete pouring.

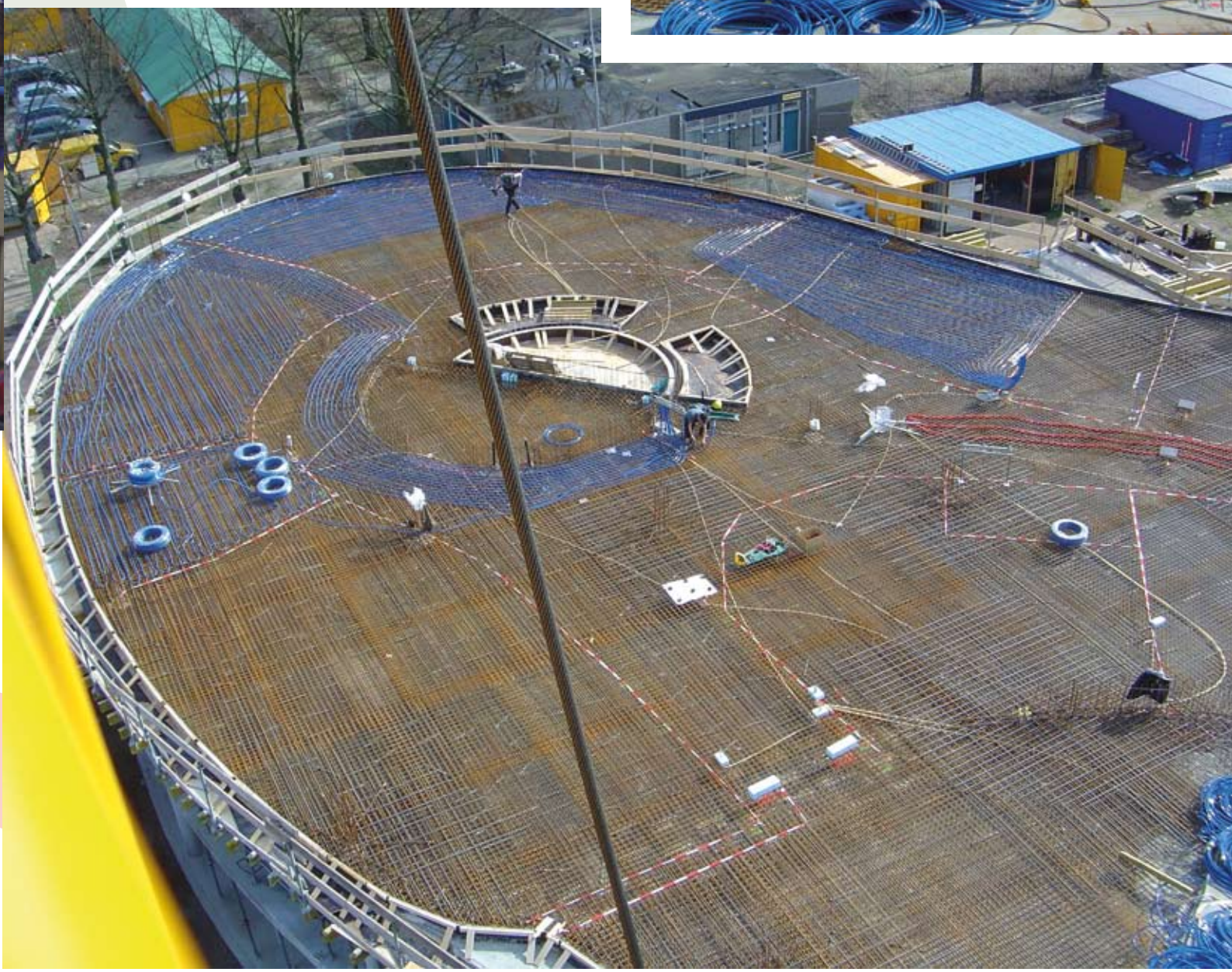
small exposed surface area, which helps reduce excess heat during summer and heat loss during winter. Well-insulated windows allow natural daylight to help light the building without causing it to overheat. To reach the cores of the building, large glass facades and a section of the roof made of glass draw maximum light into the building.

The building features three distinctive rings, which reflect the building's interior of three sections where the functions are concentrated such as sanitary facilities and terminals. This means that should the school decide to take out all of its interior walls, the building would still be fully functional.

Innovative Energy Roof

The school building will be equipped with an underfloor heating and cooling system, which regulates the heating and cooling through the surface of the floor. A concrete core activation or thermal activation of the building mass facilitates the heating and cooling. This is achieved through an extensive network of pipes running through the ceiling, and





Top and above: Work on the top floor of the building, which also includes installation of the underfloor heating and cooling system. The visible blue tubes are the some of the components that make up this system.

Top: The top floor of the school building taking shape.

Above: Entrance of the Christiaan Huygens College.

depending on the temperature of the water in the pipes, the building gets heated or cooled. Because there are no radiators, there are no draughts, and this reduces the accumulation of dust and allergens in the air.

In the summer, warmth collected from the sun and surrounding air is collected and stored 80 m below the ground. During winter, this stored heat is pumped out and used for heating the building. Likewise, as the building is heated during winter, the system collects the cold from the surroundings and stores it 80 m below the ground. This will be used to cool the building in the summer.

What makes the project is even more sustainable is the Energy Roof, which enables the school building to generate extra energy that can be used to heat the adjoining sports hall and nearby apartments.

The innovative Energy Roof was developed by Schiebroek Roofing Company in co-operation with Volantis and the Eindhoven University of Technology. It is a thermal system that consists of a solar collector with heat exchanging tubes, which is contained in the insulating material of the roof. Over this is plastic roofing that contains integrated low power generating photovoltaic cells.

The photovoltaic panels function at its best in temperatures between 25 and 30 deg C. By regulating the temperature of the water running through the tubes, the temperature of the photovoltaic cells can be kept within the optimal range.

The concrete core activation in the ceilings and the tubes of the solar heat exchanger are both linked to a geothermal heat pump underground, where both the cold and warmth are stored for use in summer and winter, respectively. This system produces more energy that what the school, adjoining sports hall and adjacent housing departments need. ■

When completed at the end of the year, the school is expected to reduce carbon dioxide emission by 98.5 percent and estimated to save €130,000 annually on energy costs. © RAU

The Dutch Approach *to sustainable construction*

There is an increasing trend to merge the fields of construction, engineering and landscaping into a fully integrated system, popularly known as 'The Dutch Approach.' This multidisciplinary approach, developed innovatively by the Dutch, has transformed an area serving one function into one that serves several to meet various needs of the people, according to Linnie Mackenzie (left), area director of the Netherlands Foreign Investment Agency (NFIA) in Singapore.

"The construction of the Christiaan Huygens College and its adjoining sports hall in Eindhoven is a clear example of 'The Dutch Approach,' whereby the collaborative efforts of the different organisations have yielded the construction of an educational institution of the future. The approach sees the merging of practicality, sustainability, efficiency and beauty as the space is utilised to its fullest potential without damaging the environment," said Ms Mackenzie.

"RAU and Liag are just a few of many architects and construction consultants in the Netherlands that are dedicated to designing and building green infrastructure. Their ideas contribute towards fighting our global climate problems by helping to minimise energy wastage and maximise savings for individuals as well as organisations."

Ms Mackenzie explained that the construction industry in the Netherlands is very healthy and robust. Among the top 100 largest construction companies in the world, the Netherlands has the fifth largest share (6.5 percent) in the total European Union civil engineering and construction output, and the country ranks second to the UK. In 2008, there were 96,660 companies operating in the Dutch construction centre of which one third of their turnover comes from exports.

She further described that high quality research and development is vital to developing the industry in the Netherlands. The country has become one of the world's leading R&D nations and the Dutch civil engineering companies invest no less than 1.5 percent of their turnover in R&D alone. This, coupled with an ambitious and innovative business and industry community, makes for an ideal landscape for any company planning to start or invest in initiatives in the field of sustainable construction in the Netherlands.

"The serious issue of climate change has also pushed the Netherlands to further develop and implement cutting edge renewable energy technologies and infrastructure, in order to continually supply its own as well as the world's ever-increasing energy demand. The experience, technology and business environment that the country offers in the sustainable construction industry complement each other, and this makes the Netherlands an excellent location for companies that want to be at the heart of the sustainable construction revolution," asserted Ms Mackenzie. ■

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