ICE HKA Netherlands Delegation

Sustainability and Innovation in the Built Environment
13 – 20 October 2024

Study reports

Study report at visit to Arup
Chan Tsz Ching Rachel

Introduction

During our first afternoon in the Netherlands, we visited the office of Arup to learn about timber hybrid structures through their project, Haut. Timber is a common construction material in many foreign countries but is seldom used in Hong Kong due to climate constraints. This seminar provided valuable insights into the benefits and drawbacks of using timber for structures, especially in the context of increasing awareness of climate change and the need to reduce carbon dioxide emissions during construction and service.

Use of Materials (Timber)

Timber is known for its ability to absorb CO2, which helps reduce the carbon dioxide content in the surrounding environment. This makes it an environmentally friendly option compared to traditional construction materials. However, using timber requires careful consideration of several criteria to ensure its effectiveness and longevity.

Durability is a key factor for timber structures. Timber can last for centuries if kept dry. The designer explained that even if timber meets water, it remains structurally acceptable if the water is drained away quickly. Prolonged moisture exposure, however, can affect its structural stability and aesthetics. In the design of Haut, concrete is used as the top and outer layer of structural parts, while timber is used in the inner parts to minimize contact with external moisture. Regular monitoring during construction ensures the timber’s moisture content remains within acceptable limits.

The potential for insect attacks is a common concern. However, the timber used in these structures is made of glue-laminated timber planks, which are generally not attractive to insects, making this concern largely irrelevant. Fire safety is another crucial aspect of timber structures. While timber is known for its flammability, designers have studied fire dynamics and implemented various active and passive measures to prevent fires and mitigate their effects. For instance, fire sprinklers have been installed on the walls for emergency use.

Design considerations

The major highlight of Haut is its river views. With the limitation of its site boundaries, designers had to develop a building that maximizes users' views. It is designed as a triangular building on the first floors and a cantilevered pentagonal building on top to prevent obstructing the views.

Structural scheme

The foundation of the building includes load-bearing diaphragm walls and steel casing piles with tension anchors, along with a two-level concrete basement. On the ground floor, a concrete floor is used, while a timber plinth is adopted. For the superstructure, a combination of cross-laminated timber and concrete is used for the floors, with cross-laminated timber for the walls and glulam timber for the columns. A concrete center core is adopted to provide higher lateral stiffness, avoiding the need for braces that would obstruct the river view.

Design challenges

The design of Haut comes with several challenges. One challenge is differential settlement, which is addressed through careful design and material selection. Footfall vibrations are mitigated by using composite slabs of concrete and timber. Ground-borne vibrations, a concern due to the building's location in an earthquake-prone area and proximity to railway tracks, are reduced by using timber, which helps absorb the impact. Additionally, adopting timber in floor slabs can cause acoustic issues due to its low mass and direct sound transfer. This issue is addressed by increasing the mass of the floor slab, using drop ceilings, and incorporating acoustic breaks.

Conclusion

In conclusion, the visit to Arup provided valuable insights into the use of timber in hybrid structures. The seminar highlighted the environmental benefits, structural considerations, and design challenges associated with timber, emphasizing its potential for sustainable construction. It also enlightened us on the importance of not being limited by site conditions while delivering engineering solutions. This experience highlighted the importance of innovative design and material selection in creating sustainable and resilient structures, showcasing timber's potential as a viable construction material.

Date of Visit: 15 Oct 2024
Location: Strand van Katwijk aan Zee (Beach of Katwijk by the Sea)
Facility Visited: Katwijk Dyke Coastal Defense
Participant: Jefferey Lung and Andrew Ng

Historically, houses located along the coast of Katwijk once served as the first line of defense against rising sea levels, endangering the lives of 3,800 residents to the possibility of potential flooding. The restrictions on excavating basements in the area limit housing options and the placement of essential facilities. Furthermore, the risk of flooding extends beyond Katwijk, with the potential for water to spread into the hinterland and threaten major cities including Amsterdam and Utrecht.

In the year 2008, to protect the coastal citizens from the rising sea level, proposals for the execution of a 1,000-meter dike-in-dune structure were developed to address the weak link in the coastal defense, creating a total defense line spanning 400 meters long. Beneath the dune, an indoor car park with a total capacity of 670 parking spaces was integrated into the design. Additionally, the coastline was extended by 30 meters toward the sea. Construction began in 2013 and was completed on 19th February 2015.

The design features of this project seamlessly combine coastal defense functions with the needs of the local coastal community. Emphasis on the dune dimensions was taken into account, ensuring that local residents' sea views remain unobstructed and that the unique character of Katwijk is preserved. By repurposing the underground dike into a much-needed parking facility, the project encourages local participation, addressing the parking shortage expressed by residents. Additionally, water seepage from the underground garage will be pumped into the Rhine, contributing to local water management.

With a focus on future generations, the design prepares for potential sea level fluctuations over the next 50 years, aligning with the Netherlands Delta Programme's vision for flood risk and water management. This innovative structure is engineered to withstand water levels corresponding to a one-in-10,000-year event, safeguarding inland areas against the North Sea.

To further preserve the cultural identity and natural landscape of the area, sand is sourced from the North Sea bed, maintaining the beach's original functions and aesthetics. The erosion of the sand dune protects the man-made features underground, while sand collected from the village is returned to the beach, ensuring sustainability. The design infuses the white structure with the surrounding beach landscape, concealing the dike within a visually appealing dune that connects seamlessly to the onshore boardwalk. By recreating the beachfront landscape with local sands and planting marram grass, the project enhances access from the community to the beach while maintaining local leisure areas, tourism attractions, and natural habitats. Expanded public spaces provide residents with opportunities to walk, meet, and enjoy their environment, with added seating and playgrounds to foster a sense of community and connection to the area.

ICE HKA Netherlands Delegation 2024 - Uithoflijn Tram

Mr. Wong Cheuk Kin, Jacky
Mr. Leung Chun Hei, Winson

Introduction

When major modes of road transportation such as buses have reached their capacity in terms of patronage, complementary modes may be considered to reduce traffic congestion. In Utrecht, tram was selected as the way out. Uithoflijn Tram, an 8-kilometer long tram line, was established to connect the central station to universities, science parks and new development areas.

Utrecht did not stop with the tram line. With an ambitious 20-year master plan named CU2030 to transform the central station and rebuild the cityscape, Utrecht aimed to advocate three areas of refinement - Recover, Connect, and Give Meaning.

Recover

Utrecht was initially split into two parts by the central station. Owing to the prevalence of car ownership in the mid-20th century, a motorway was constructed to link up the two parts. In recent decades, promotion of active transportation such as cycling and walking within the Netherlands had led to decommissioning of the motorway and restoration of the once beauty canal named Catharijnesingel beneath the motorway for more urban spaces. However, what about the connection between the two parts of Utrecht?

Connect

The connection of the central station and two sides of the city was then replaced by elevated pedestrian walkways and cycle tracks with park-and-ride facilities. Along with the redevelopment of the central station, two main arteries were designed to facilitate pedestrian movement via the footbridge or the periphery of the central station.

A 3-storey parking facility was featured below the central station, which was surprisingly not for cars but bicycles. An astonishing number of 12,500 parking spaces are provided with bicycle ramps for ease of access, adding up to more than 32,000 bicycle parking spaces in the city centre. This world's largest bicycle parking facility greatly promotes zero emission active transportation and alleviates the traffic congestion in the vicinity of the central station.

Give Meaning

The original central station was buried in the dense cityscape of Utrecht. Wayfinding was sometimes frustrating and the station entrance was not recognisable. Since then, the station was renovated to stand out and have its own character.

Various efforts in public engagement and stakeholder liaison had turned the roof of the piazza to somewhat similar to an eggette, forming a unique landmark feature that is visually accessible from both sides of the central station.

Not to steal the thunder of the historic monuments and identity of the city, all new buildings under the CU2030 have to be built lower than the height of the iconic Dom Tower in the city centre, striking a balance between prosperity and conservation.

Conclusion

Evolution of cities always involves infrastructure development, the question is how and what. For a sustainable living and built environment, meaning may be given to the cities along with the accomplishment of diverse goals. Liveliness, harmony and traditions may be incorporated simultaneously to economic growth.

In the coming development of the Northern Metropolis, it is worthwhile to delve into the feasibility of underground bicycle parking and bicycle expressways to reduce the emission generated from feeder transport. In the urban planning process, inclusion of historic cultures such as the indigenous villages in the New Territories may be promoted. Potential of the Northern Metropolis to become the exemplar of new development areas within the region would soon be unleashed.

From: Chan Mung Yin and Lee Yuen Fai Date: 25 Oct 2024

ICE HKA "Sustainability & Innovation in Built Environment" Delegation Visit

Discussion on the Visit of Afsluitdijk Dam (16 Oct 2024)

The Afsluitdijk Dam is an iconic structure of Dutch engineering and stands as a testament to the Netherlands' mastery of water management constructed between 1927 and 1932. This 32Km long dyke, with a width of 90m and height NAP +7.6m, not only serves as a protective barrier against flooding but also as a symbol of the country's resilience and innovation. For ecology, it has a fish migration opening and fish-safe pump to allow the safe passage of fish in both directions through the dam i.e. can migrate from salt to fresh water and vice versa for reproduction. This shows a care to the environment to preserve as much as possible. Other measures include: rough top layer levvelblocs and notches, seeds replaced in Quattroblocs, and herb-rich grass mixture on crown and inner slop.

The visit was introduced and guided by Mr Anton Driesse, Senior Structural Engineer and his colleagues.

Maeslantkering

by Jeff SUEN and Henry CHAN

On 16 October 2024, our delegation had the opportunity to visit the Maeslantkering, a remarkable storm surge barrier located in the Rotterdam area of the Netherlands. This engineering feat is a critical component of the country's comprehensive flood defense system, designed to protect low-lying regions from the potential threats posed by the North Sea. Constructed between 1991 and 1997, the Maeslantkering was built as part of the Delta Works, a series of dams, sluices, locks, dikes, and storm surge barriers designed to protect the Netherlands from flooding. The barrier spans 240 meters in length and rises 22 meters high, featuring two massive gates that can each weigh up to 6,800 tons. The gates are designed to close automatically when water levels reach a predetermined threshold.

Our visit commenced with an informative presentation from the Maeslantkering engineering team, who outlined the history, design, and operational principles of this extraordinary structure. The barrier utilizes sensing technology to monitor water levels in real time, ensuring that the gates can respond swiftly to changing conditions. The control system is designed to work seamlessly with weather forecasts and tide predictions, enhancing the overall effectiveness of flood management.

Following the presentation, we embarked on a guided tour of the facility and the water management information center. Engaging discussions with the team provided deeper insights into the challenges of climate change, particularly regarding rising sea levels. The visit underscored the importance of investing in resilient infrastructure to protect vulnerable coastal communities. It was evident that both the Maeslantkering and the WMIC serve as symbols of proactive environmental stewardship and innovative water management.

ICE HKA Netherlands delegation 2024

Study Report on Visit to TU Delft on October 17, 2024

Prepared by Choi Chi Pang Bernie & Lam Wai Kin Ricky

On October 17, 2024, we had the opportunity to visit Delft University of Technology (TU Delft), where we engaged with leading researchers and learned about their innovative projects and facilities. The visit began with a presentation by Assistant Professor Broere Wout, who provided an insightful overview of TU Delft's rich history and its role as a top-tier institution with eight faculties and numerous state-of-the-art research facilities.

Professor Wout highlighted key research centers, including QuTech, the Reactor Institute, and various specialized labs such as the Hexapod, Wind Tunnel, and WaterLab. These facilities underscore TU Delft's commitment to addressing global challenges, including climate change, energy transition, urban growth, digital society, and health. The university's strong international standing and the accomplishments of its alumni in various fields further reflect its impact on society.

A particularly fascinating part of Professor Wout's presentation was his discussion on the research program focused on immersed tunnels. He described the use of a distributed optical fiber measurement system to monitor joint deformations in these tunnels. This advanced sensing technique can detect sub-millimeter deformations and conduct high-frequency monitoring, allowing for precise measurements of the daily expansion and contraction of the tunnel elements. Notably, the research revealed that the entire immersed section experiences periodic upward and downward movements due to tidal variations, with seasonal effects showing cyclic joint openings and closures influenced by temperature changes.

Following Professor Wout's presentation, we had the opportunity to visit the laboratories at TU Delft. This tour allowed us to see firsthand the cutting-edge research being conducted.

After the lab visit, Associate Professor Apostolos Tsouvalas from the Offshore Engineering section took the stage to explain the complexities of offshore engineering. He introduced various aspects of the field, including computational multiphysics, fluid-structure interaction, and environmental vibrations. His insights into offshore wind trends, foundation types, and the challenges posed by Arctic conditions were particularly enlightening. Professor Tsouvalas emphasized the importance of structural health monitoring and the need for innovative solutions to ensure the sustainability of offshore structures.

Overall, our visit to TU Delft was incredibly enriching. The presentations and laboratory tour provided us with valuable insights into the university's commitment to advancing knowledge and addressing some of the most pressing challenges facing our society today. We are inspired by the work being done at TU Delft and look forward to future collaborations and learning opportunities.

Study Report on Dieseko Piling Factory Visit

Date of Visit: 17 October 2024 (Thursday)
Location: Dieseko Group, Netherlands
Prepared by: David Lau and Kelvin Chong

Introduction
As part of the 25th-anniversary celebrations of the Institution of Civil Engineers (ICE), our delegation had the privilege of visiting the Dieseko Group's piling factory in Sliedrecht, located in the north of the Netherlands. Dieseko Group is renowned for its advanced construction technology, especially in the fields of vibratory hammers and hydraulic pile-driving solutions. This visit provided us with invaluable insights into Dieseko's ambitious vision for an emission-free construction industry and the pioneering technology it is employing to reach that goal.

Overview of Dieseko Group
Dieseko Group specializes in equipment and solutions for piling and foundation, serving construction projects worldwide. With a strong focus on reducing environmental impact and increasing efficiency, the company is dedicated to addressing the challenges of a changing construction landscape. Their innovation spans from energy-efficient machinery to equipment that meets stringent global emission standards.

Strategic Roadmap: Towards an Emission-Free Construction Site by 2030
A key highlight of the visit was learning about Dieseko Group's sustainability commitment. The company has set an ambitious goal: to achieve a completely emission-free construction site by the year 2030. This commitment is outlined in Dieseko's strategic roadmap, which includes a focus on electrification, energy efficiency, and circular economy principles. The roadmap not only targets carbon neutrality but also addresses noise reduction and waste minimization—both essential for urban construction projects.

1. Electrification of Equipment
   Dieseko has invested heavily in the development of electric-powered piling equipment, reducing reliance on traditional diesel engines. Electrification helps cut down emissions and reduces operational noise, making these machines ideal for urban environments where noise and pollution control are critical.

2. Energy Efficiency
   Their advanced technology prioritizes energy-efficient designs, which not only improve the equipment's performance but also significantly lower fuel consumption. This approach directly supports Dieseko's sustainability goals and aligns with international standards for environmental impact.

3. Circular Economy Initiatives

Dieseko’s strategic roadmap also integrates circular economy principles. By designing machinery that is modular and easily upgradeable, the company ensures that equipment has a prolonged lifecycle and can be refurbished rather than discarded, thus minimizing waste.

Revolutionary Technology and Sustainable Practices

Dieseko’s cutting-edge technology is transforming the construction industry by promoting sustainable practices while meeting the high demands of modern construction projects. Here are some of the technologies we explored during the visit:

1. Vibratory Hammers and Resonance-Free Technology

Dieseko is a leader in vibratory hammers with resonance-free technology, which prevents harmful vibrations from affecting nearby structures. This feature is particularly valuable in densely populated areas, as it minimizes disruption to surrounding infrastructure while maintaining efficient pile-driving performance.

2. Hydraulic Piling Machines with Automated Systems

Dieseko’s hydraulic piling equipment incorporates automated systems, which enhance precision and reduce human error. By improving operational accuracy, these machines help reduce unnecessary energy expenditure and increase safety on-site, aligning with Dieseko’s sustainability goals.

3. Noise Reduction Technology

Dieseko is advancing technologies that address noise pollution, a common challenge in construction. Their equipment incorporates sound-dampening features that enable quieter operations, an essential factor in urban construction zones. This aspect is crucial in meeting environmental standards and improving worker conditions on-site.

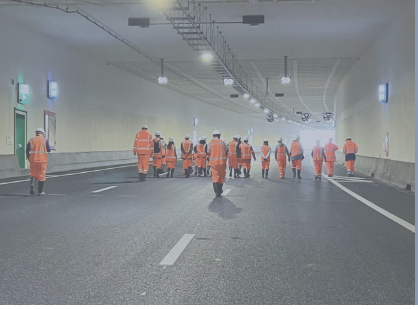
Commitment to Innovation and Sustainability

Dieseko’s commitment to innovation is not limited to their technology but is also evident in their collaborations and investments. By partnering with universities, research institutions, and industry stakeholders, Dieseko remains at the forefront of sustainable practices in construction technology. Their proactive approach in anticipating environmental regulations has positioned them as a leader in sustainable construction.

Conclusion

Our visit to Dieseko Group in Sliedrecht was an insightful experience, showcasing how a commitment to sustainability and innovation can reshape the construction industry. Dieseko’s strategic roadmap and technological advancements are not only pioneering but also serve as a benchmark for other companies aiming to reduce their environmental impact. Their vision of an emission-free construction site by 2030 is ambitious, yet the technologies and sustainable practices already in place highlight that this goal is within reach.

Dieseko Group is paving the way toward a more sustainable future in construction, embodying principles that align closely with the Institution of Civil Engineers' mission to improve society through innovation and expertise.

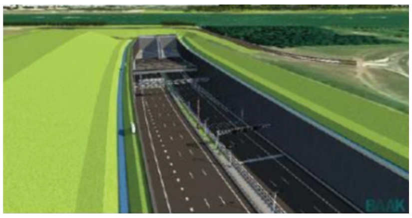


A24 BLANKENBURGVERBINDING

WENDY HO GENNY CHOW

INTRODUCTION

The A24 Blankenburgverbinding (DBFM Blankenburg Link A24) is a transformative infrastructure project in the Netherlands. It's a four-kilometer motorway that connects the A20 motorway in Vlaardingen (North Bank) with the A15 motorway in Rozenburg (South Bank), providing a robust motorway network to the densely populated Rotterdam region; strengthening the connection between Rotterdam Port, largest seaport in Europe, and the economic heart of the Netherlands, the Randstad; whilst minimising the environmental impect on the region.



PROJECT SCOPE

The Project comprises of a recessed junction starting from the North Bank, connecting to an approximately 1.35km long land tunnel (Holland tunnel), with a closed section of 510m to be constructed in an environmentally sensitive area, and an approximately 945 metres long immersed tunnel (Maas Delta tunnel) including an immersed section of 385m, comprising of two elements with lengths of 185 and 205m under the river of Het Scheur, followed by an above-ground junction connected to the A15 on the South.

TENDERING

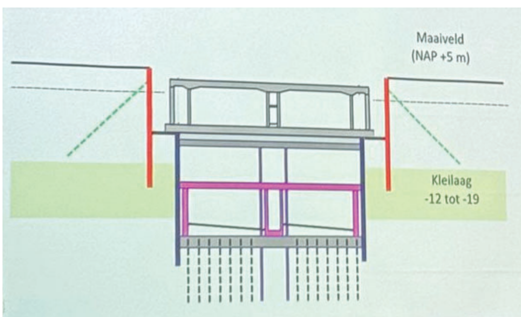
The Project is a DBFM (Design Build Finance Maintain) project with a 20 years of maintenance period, this accelerates project delivery whilst saving cost.

The Tender Assessment weighing is 50% on Price and 50% on Quality including sustainability aspects.

Apparently, the winning bid was not the most affordable option, but the sustainability potential with the design and reduction in hindrance had made up for it.

IMMERSED TUNNEL

The immersed tunnel comprises of two tunnel elements. Obstacles was encountered due to the extra deep ramp required, complex phasing was needed to facilitate the immersion process. Eventually, two 200m long tunnel elements was constructed in a dry dock nearby, the tunnels was then sunk to a depth of 27m deep and connected under water to complete the 945 metres long immersed tunnel.



ENVIRONMENTAL CONSIDERATION

Design Consideration

The junction between the A24 link and the A20 on the nothern side was recessed for about 4m below ground level to preserve the green landscape around the area.

Meterial Consideration

Reinforced under water concrete was used for better sustainability by reducing consumption of materials and thus, lower the CO2 emission

Tendering - The DuboCalc Method

During the Tendering phrase, a special assessment method which is widely adopted in the Netherland, namely the Dubo Calc, was used to examine the sustainability aspect of Biddings. It is a Life Cycle Assessment tool designed for Civil projects by calculating the potential impact through out their entire lifecycle and converting into units of MKI (Environmental Cost Indicator). Enabling the project team in selecting the most cost and environmentally effective Bid.

Study Report: AECOM Netherlands Schiphol Airport's Pier A Construction Project

Kan Ka Leung, Cheung Lung On

Introduction

AECOM Netherlands is engaged in landmark projects, including strengthening climate resilience in cities like The Hague and Rotterdam, delivering construction management services for iconic high rises in Amsterdam, and advising various industrial clients. During the sharing section, AECOM shared their new Pier A at Amsterdam’s Schiphol Airport project aimed at enhancing the airport’s capacity and sustainability.

Project Overview

Amsterdam’s Schiphol Airport connects the Netherlands to 313 destinations, making it one of Europe’s busiest aviation hubs and a key economic driver. Pier A, the ninth and latest addition, features eight new gates and boasts impressive sustainable design credentials.

Sustainable Design

Sustainability was a key focus, with the pier designed to achieve LEED Gold certification. Sustainable features include:

Biomaterials: Use of natural, renewable resources to reduce environmental impact.
Insulating Glass: Enhancing energy efficiency by reducing heating and cooling demands.
Recycled Plastic: Minimizing waste and reliance on non-renewable resources.
Solar Panels: Harnessing renewable energy to decrease fossil fuel use.
These elements contribute to making Pier A the most sustainable structure at Schiphol upon completion.

Digital Delivery

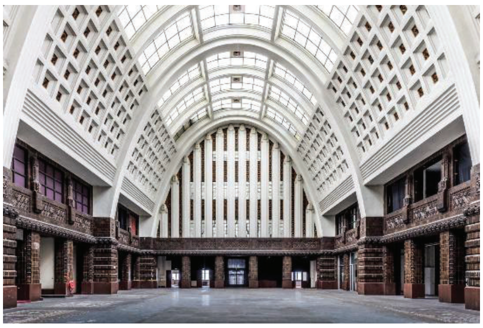
Common Data Environment: Facilitated seamless information exchange and coordination across disciplines.
3D BIM Tools: Enabled precise coordination, improving collaboration, and streamlining processes to keep the project on schedule.

Conclusion

During a visit to the AECOM office in the Netherlands, the staff provided insights into the company's history, values, and scale. Two employees showcased projects they were involved in, highlighting Schiphol Airport's Pier A and the Postkantoor in Rotterdam.

The construction of Pier A represents a significant milestone in Schiphol Airport’s development, enhancing both capacity and sustainability. The innovative use of sustainable materials and digital tools sets a benchmark for future projects, contributing to a lower-carbon future and climate risk mitigation. In our future Hong Kong project, we can refer to the new Pier A project in Netherlands to design a more sustainable building to mitigate against climate risk.

In Rotterdam, the historic Postkantoor is undergoing a transformation into a dynamic civic hub blending residential, retail, and hospitality elements. The project involves restoring the grand Great Hall and introducing a new 150-meter tower to complement the existing structure. Public amenities, including a five-star Kimpton hotel, are being integrated to revitalize Rotterdam's city center, connecting it with key locations like Rotterdam Centraal and the Markthal.
The projects at the AECOM office in the Netherlands revealed a blend of historical preservation, innovation, and sustainability. Schiphol Airport's Pier A and the Postkantoor in Rotterdam showcased how design can transform spaces, balancing the past with the future. This visit emphasized the impact of thoughtful urban development and collaborative design on creating functional, culturally rich environments.



ICE HKA Netherlands Delegation 2024
Participant Name: Lee Chau Tung

On 19 October 2024, we visited the Cruquius Museum, which tells the story of the age-old Dutch battle against water. The sea level in the Netherlands is very close to ground level, which has historically led to frequent flooding and significant destruction of homes, particularly in Haarlemmermeer. Since the late 18th century, Haarlemmermeer expanded by 2,500 square meters per year, threatening to swamp or swallow Amsterdam and Leyden. In response, the Dutch developed innovative strategies to combat water.

After the storms of 1836, both the provincial government of Holland and the city of Amsterdam planned to drain Haarlemmermeer Lake. However, draining the lake posed challenges, including the loss of water buffering and difficulties in transporting goods to and from Amsterdam and Leiden. Additionally, there was the question of which power source to use for the pumping stations. Ultimately, King Willem I decided to implement steam power for the steam-powered pumping stations. The drainage project involved numerous parties, including civil engineers, laborers who built dikes, artisans who wove willow branches into “griend” mats, construction workers, and land contractors.

The project initially aimed to use Dutch peat to fuel the steam engines, but peat lacked sufficient calorific energy to produce enough steam. Consequently, coal was required. At that time, coal was not mined extensively in the Netherlands, necessitating imports from the UK, Belgium, and Germany. Ships transporting coal docked at a jetty beside the pumping station, where the coal was unloaded into large bunkers. From there, coal shovels transported the fuel into the building to feed the ever-hungry fires.

The Haarlemmermeer drainage project employed 450 laborers, 83 horses, four chain-operated and horse-powered treadmills, and 12 pile-driving machines. These workers persevered against the odds to drive 1,700 fir piles, each 22 meters deep, to support the foundations of the Cruquius. Although it may have seemed an impossible task, they succeeded. The total cost of draining the lake was 14 million guilders. Subsequently, selling the newly drained land in the polder generated 8 million guilders, resulting in a net cost of only 6 million guilders. Today, this equates to approximately 70 million euros, a relatively modest amount for such a significant project.