IPA News Letter Volume 8, Issue 2 June 2023

Report

Application of the GYRO PILER to replace damaged quay walls in Amsterdam

Andrew McNamara

Senior Lecturer
City, University of London

Jignasha Panchal

Technical Manager
Keltbray Holdings Limited

The city of Amsterdam was built around a dam on the Amstel River during the late 12th century. The city is well known for its historic canals and waterways which have been the predominant method for transporting goods, services and people across the country. The waterways are still very much in use and are a highly efficient means of working and moving around the city although the original construction dates back as much as 100 years.

The sides of the highly trafficked waterways are retained with brick walls that are supported on ancient timber piles. The walls require regular repair owing to erosion caused by the high velocity of water from the propellors of barges navigating very tight bends. This causes washout of the retained soil which results in sink holes, as shown in Fig. 1. There are many examples of stretches of canal where the local council has carried out remedial works and installed conventional sheet piled walls in front of the eroded canal walls, which were subsequently backfilled to provide lateral restraint to the walls (Fig. 2). This is not a particularly cost effective or aesthetic solution and results in narrower waterways; a schematic diagram of the remedial works is shown in Fig. 3.

Fig. 1. Photograph of sink hole appearing alongside the canal wall (Giken, 2023)

Fig. 2. Remedial works installed for temporary stabilization

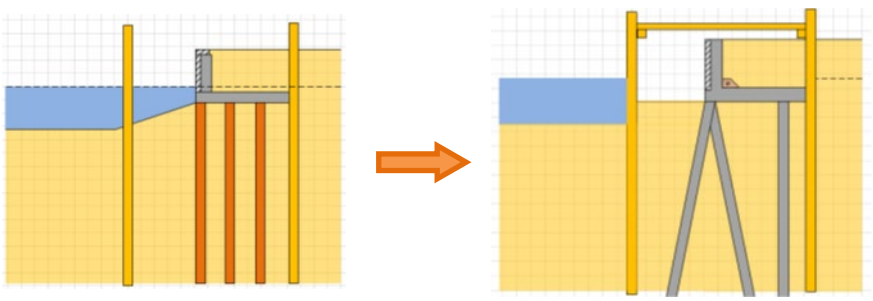


Fig. 3. Schematic diagram of the current remedial works undertaken using sheet piles (Giken, 2023)

Project details

A site was identified at Singel in the heart of Amsterdam which required an urgent and innovative long-term solution to improve the integrity of the retained canal walls, without disrupting the local walkways and roads. This site was identified as suitable for a pilot project that could be used to demonstrate the viability of new construction technologies with the aim of applying the generic solution to the repair and replacement of approximately 600km of historic canal walls across Amsterdam.

A collaborative project team, G-KRACHT, was formed of Giken Europe, De Koning and H G Van Gelder. The final proposal made use of the GIKEN GYRO PILER, which allowed construction to take place from a barge next to the canal, with access to the site and delivery of materials all taking place from the waterway. This construction technique reduced the overall construction program as the method of working eliminated the requirement for a temporary works access platform.

The scope of works began with the installation, preparation and mobilization of plant and equipment on the barge. 508mm diameter tubular piles of 9mm wall thickness, were designed as the primary means of retaining the canal walls and were installed along and through the existing brick wall line, see Fig. 4. The benefits of the GYRO PILER, to core through existing structures and obstructions, including timber, was demonstrated on this project as it avoided the need to carry out any extensive and disruptive enabling works. The tubular piles were installed to an average depth of approximately 23m and a lubricant was pumped along the length of the pile to ensure that the cutting head could push through the obstructions. For every 508mm diameter tubular pile, one 273mm diameter closure pile was installed to approximately 14m using a driving head mounted on an excavator which was working from the barge (Fig. 4). Tie rods were installed to each of the tubular piles as shown in Fig. 5.

Fig. 4. 23m deep x 508mm diameter piles with shorter small diameter closure piles between

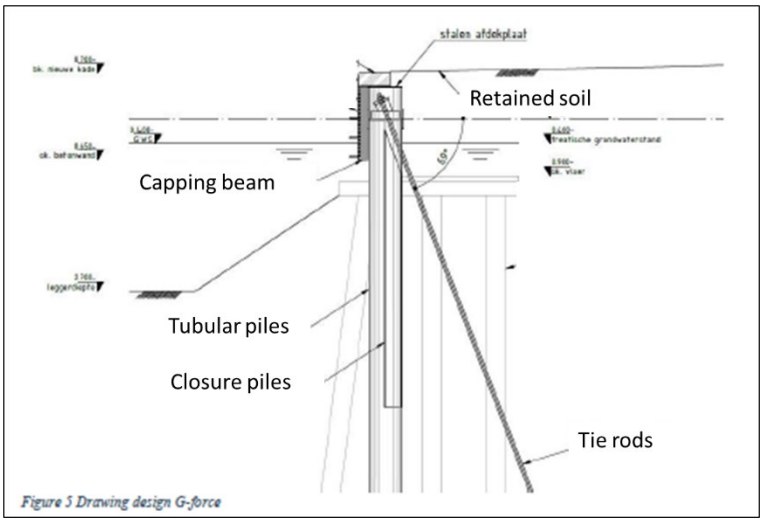


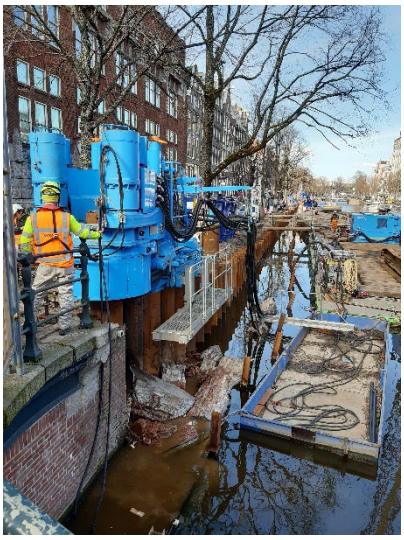
Fig. 5. Section of the remedial works proposed to the quay wall showing tubular piles and inclined tie rods and small diameter closure piles

Photographs taken during the site visit are presented in Fig. 6 showing the site set up that was used to carry out the works. The works were restrained to the quay wall and all service equipment was located on the barge thereby minimizing disruption to the general public and pedestrian walkways immediately adjacent to the site.

(a)

(b)

(c)



(d)

(e)

Fig. 6. Photographs of (a) the piling site and barge, (b) the GYRO PILER set out on the pile, (c) the tubular pile half installed in the pile position, (d) the brickwork obstruction that was driven through using the GYRO PILER, and (e) the short closure piles being installed using the attendant excavator from the barge.

The GYRO PILER GRV0611e was deployed for this project and has the capacity to install piles between 500-600mm in diameter and can apply up to 1.2MN force during the driving and extraction process. The operation of the equipment was controlled remotely, limiting the requirement for operatives to be at the face of the pile driving process. Tubular piles were stored on the barge and were supplied to the GYRO PILER using the service crane before being rotated and installed through the existing brickwork and underlying strata. The speed at which the pile was installed and the minimal noise, vibration and disruption to the local surroundings were evidently minimal during the works demonstrating that this technique is well suited to the inner city and developed areas.

Conclusion

The GYRO PILER has been used to successfully install a remedial piled wall along a canal in Amsterdam. Restrictions on site included extremely confined working conditions with site access for materials and equipment possible by canal only. Environmental constraints included the need to protect mature trees and minimize settlements and any nuisance to the general public. The technique adopted was able to overcome all of the constraints whilst installing tubular piles through difficult obstructions that included timber piles and was successful in minimizing disruption to the surrounding area.