As part of the extension project at the Zeebrugge gas terminal, Fontec, the Belgian subsidiary of Solétanche Bachy, was awarded the contract for the diaphragm wall works for a Liquid Natural Gas reservoir. Solétanche Bachy carried out the work as the lead contractor in partnership with Technigaz and MBG working under a design and build contract.

The reservoir is a shaft with an internal diameter of 90.50m and a storage capacity of 140,000m$^3$. The other three

<table>
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<tr>
<th>CLIENT:</th>
<th>FLUXYS LNG N.V</th>
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<tbody>
<tr>
<td>SUPERVISING ENGINEER:</td>
<td>FLUXYS LNG-TRACTEBEL</td>
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<td>CONTRACTORS:</td>
<td>TECHNOGAS - FONTEC - MBG</td>
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<td>DURATION OF THE DIAPHRAGM WALL WORKS:</td>
<td>OCTOBER 2004 TO FEBRUARY 2005</td>
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**MAIN QUANTITIES:**

- Diaphragm wall: 11,300m$^3$
- Diaphragm wall depth: 39.5m
- Earthmoving: 166,000m$^3$
- Reservoir storage capacity: 140,000m$^3$
reservoirs were constructed by Solétanche Bachy in 1982 using a 1.5m thick diaphragm wall and a 800mm thick inner wall. Advances in design methodology made possible a lighter structural solution for this new reservoir: it uses a 1.20m thick diaphragm wall down to a depth of 39.50m, with an excavated depth of 25m (in part of 28m).

As the project is located on a gas storage site, particular attention was paid to safety and procedures were tightened as a consequence. There were further challenging requirements: a minimum concrete strength of 40MPa was needed to meet the calculated stress levels in the arch form wall. This, in turn was dependent on a 0.5% verticality tolerance and perfect wall continuity between panels. These requirements gave rise to a need for increased quality control to monitor the works on a continuous and daily basis.

The walls were constructed using a KS3/2 steerable hydraulic grab and a mechanical grab, both equipped with vertical alignment recording systems. The circular diaphragm wall construction comprised 43 panels measuring 6.68m in length and 39.5m in depth (the wall’s developed length along the circular wall axis = 287m). The excavation of the diaphragm walls passed through fill, clayey sand and compact sand with a 3m minimum embedment into clay.

CWS joints (stop end with waterstop) were used for the connection between panels. Vertical alignment, including any twisting, was very closely monitored in order to ensure good circular wall continuity.

Once the diaphragm wall had been completed, the construction of the concrete capping beam was commenced, followed by bulk excavation inside the wall. Nine inclinometer tubes and 24 strain gauges were integrated into the wall for the purpose of monitoring its behaviour during the bulk excavation inside the shaft and during construction of the LNG tank.