

TRENCHLESS INTERNATIONAL

ISSUE 43 | SPRING 2019



FUTURE PROOF

Culvert installation protects against hurricanes – page 18

The official publication of
the International Society for
Trenchless Technology

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WATER UNDER THE BRIDGE

In May 2018, Risanamento Fognature relined a steel water pipeline anchored under the Academic Bridge in the centre of the historic Venice. The challenging trenchless project was part of a larger operation to protect the bridge, which is a popular tourist attraction, featuring some of the most icon views of the city.

At the end of 2017, renovation works on the Accademia Bridge in Venice, Italy commenced, coordinated directly by the Maintenance and Viability office of the Venice Historic Centre – Public Works Directorate of the Municipality.

The large wooden bridge – considered striking within the city’s stone architecture – crosses the Grand Canal towards the lower southern end of the city, linking the San Marco district with the Accademia gallery in Dorsoduro. From the bridge, tourists can see two of the most beautiful views in Venice: on one side lies the dome of Santa Maria della Salute church and on the other is a quieter bend, which eventually takes the canal towards the Rialto Bridge.

The jobsite required the construction of important temporary works to ensure pedestrian accessibility and access to the work site, while minimising the impact of the site on the delicate urban fabric of Venice. The goal was, given the importance of the works on the bridge, to renew all the dated artefacts present within the bridge.

PIPELINE RESTORATION

During the works, water and wastewater utility Veritas SpA engaged Risanamento Fognature to assist with the rehabilitation of a 70 m section of abandoned steel drinking water pipeline with an outside diameter of 324 mm, operating pressure of 3 bar or lower, in an arched shape with a vent at the top.

The pipeline had served the city centre since it was laid in 1964. At the time, it had been installed to replace a pre-existing sub-basin siphon with a diameter of 400 mm from the beginning of the 20th century which had subsequently been abandoned.

Inspections had to be carried out to determine the state of the pipeline, with an ultrasound inspection system selected for its ability to precisely measure the thickness of the tube. Using a specialised method based



A: The underside of the Academia Bridge.
 B: The steel water pipe system.
 C: Venice's historic Academia Bridge.
 D: Relining taking place within the host pipe.



B



C



D

on the acoustic propagation data of an induced sound wave and using patented algorithms, it was possible to convert the data to a measure of the minimum wall thickness.

This was calculated as the average residual thickness of the pipe segment inspected. The resulting data showed a significant reduction in pipe wall thickness.

Given the results of the investigations and the maintenance work already being carried out by the Municipality of Venice on the bridge, Veritas decided to initiate plans to replace the pipeline and ensure its safety.

INSTALLATION PHASES

Considering the replacement would have taken a long time and been expensive, internal rehabilitation with a trenchless relining technique was instead selected. Works took place over a number of phases

during May 2018, with hydraulic work of cutting heads, tests and reconnections carried out by Veritas and pipeline reorganisation undertaken by Risanamento Fognature.

Pipe preparation

On 25–28 May, decommissioning of the pipeline began with the construction of the two pipe cuts on the bridge heads and provision of flanges for subsequent connections. It was advised that flanges should be prepared before relining, as once the liner has been set, the temperature at the weld could damage the liner.

Hydrodynamic cleaning

On 29 May, high pressure cleaning of the pipe took place using equipment with a pressure of 600–700 bar. This was done to eliminate any crustations present. After

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cleaning operations took place, a final video inspection was carried out with a robotised camera.

Liner impregnation

At 6am on 30 May, the fibreglass reinforced polyester liner was impregnated with special resins and contained in a system enclosed by high density polyethylene films.

The impregnation took place under vacuum with a closed-circuit computerised impregnation system, while the epoxy resin for potable use was kept constantly at low temperatures to prevent the curing process from beginning early.

Transportation

At 6.30am, a boat transported the liner from the quay to the Accademia bridge; to maintain the low temperature, ice was used. The sheath was then loaded onto a compressed air inversion drum.

Structural consolidation

From 8am to 7pm, the impregnated liner was inserted into the deteriorated pipe and expanded with steam pressure, fitting it to the

existing pipeline. The system ensured the uniform thickness of the coating, compliance with the original diameter of the pipeline, an increase in hydraulic characteristics and a restoration of great strength and durability.

Accessory assembly

The following day, on 31 May, the Inox/Epdm sealing joints were mounted on the liner heads. To cope with the arched shape of the restored pipe, an innovative 1 inch (25 mm) vent plug collar was installed on the top of the hose rehabilitated with liner.

Testing

After accessory assembly and at the end of the intervention, a final watertightness test was performed testing at 1.5 times the

working pressure in accordance with UNI EN 805.

CHALLENGES

Areas of the Veritas shipyard partially affected the structure of the bridge, which meant the works were mainly carried out in correspondence with two small rooms located at the ends of the structure. This, in combination with continuous communication and coordination, made it possible to avoid interfering with the renovation work being carried out by the Municipality of Venice.

Logistical difficulties meant it was important to evaluate and select the most compact equipment possible. Overall, the rehabilitation works took a total duration just 12 days to complete. ①

ABOUT RISANAMENTO FOGNATURE

Over a number of years, Risanamento Fognature has developed a highly efficient working method, successfully developing and providing carefully researched solutions and non-destructive technologies. Its qualified technical and operating staff are equipped to provide equipment for visual inspection, non-destructive systems for pipeline repair, as well as continuous updating and training of personnel.

For more information visit www.risanamentofognature.it

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