Jetty Pile Corrosion Protection Jacket

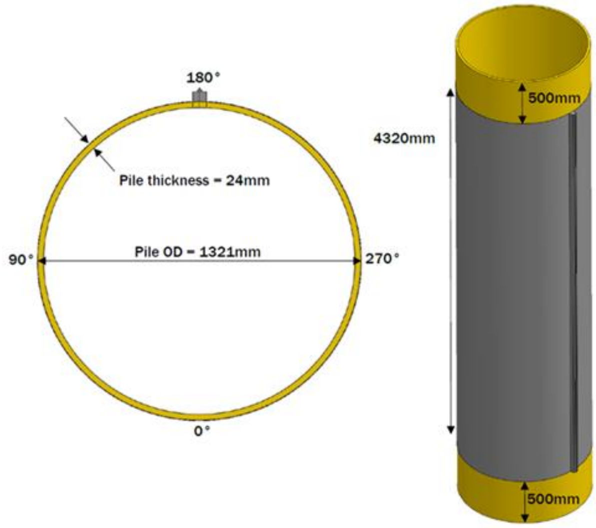
Our approach

EASL's expertise in finite element analysis (FEA) provided clear and concise advice to the client.

EASL was chosen by the client to analyse the effectiveness of a corrosion protection jacket for a jetty pile.

A three dimensional (3D) FEA model of a vertical steel pile and the corresponding protective jacket assembly was created. The 3D model was then used to determine the continued effectiveness of the jacket protection system under a bounding thermal load. The model comprised a section though the steel pile and the high density polyethylene (HDPE) jacket assembly.

The results from the FEA were used to confirm whether thermal expansion and accompanying stress relaxation of the jacket assembly would lead to a reduction in the jacket contact pressure and ultimately the jacket assembly slipping down the pile, thus leaving it exposed to the corrosive effects of sea water. Safety factors were calculated by comparing the frictional force associated with the contact pressure after thermal expansion to the weight of the jacket assembly plus marine growth.



Methodology

The EASL team carried out the analysis in three stages. The first stage consisted of steady state heat transfer to determine the temperatures at all points in the model. In the second stage pre-tensioning of the jacket assembly was simulated. The jacket is manufactured smaller than the pile diameter and is stretched around the pile using a hydraulic tensioning device thereby introducing a hoop strain into the jacket. The third stage uses as input the stress field post tensioning, the steady state temperature field and wave suction pressure loading, and analyses stresses in the jacket and contact pressure between the jacket and the pile.

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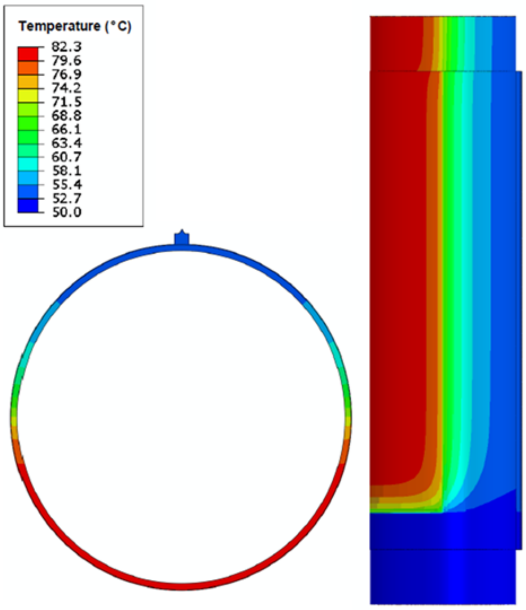
2 Edward Court, George Richards Way, Altrincham, WA14 5GL

0161 923 0070 www.easl-stress.co.uk



Results

EASL concluded with two sets of results that were extracted from the analysis; the radial thermal expansion at the bottom of the jacket assembly/ the corresponding location on the pile, and the average contact pressure between the jacket and the pile.

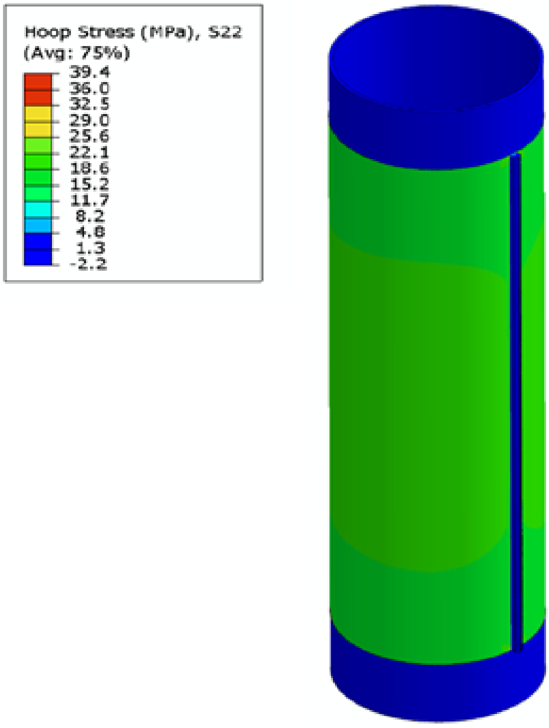
Thermal expansion – to determine whether any gaps would appear between the jacket assembly and the pile, radial expansion was extracted from the analysis. The results showed no separation between the jacket assembly and the pile for the majority of its circumference.

Contact pressure – the contact pressure between the inside surface of the jacket and the outside surface of the pile was reviewed. A positive contact pressure was evident over the majority of the circumference.

Safety factor – safety factors were derived from the frictional force associated with the contact pressure after thermal expansion divided by the weight of the jacket assembly plus marine growth. Safety factors greater than two were calculated for all operating states over the entire intended lifetime.

Conclusion

EASL analysed the corrosion protection jacket for a jetty pile. The results showed that under the worst thermal conditions, the largest gap between the jacket and the pile would be small enough to prevent the ingress of corrosion sea water. Although thermal expansion and relaxation of the pre-tension in the jacket leads to a reduction in the jacket to pile contact pressure, the safety factor against jacket slip remain greater than two for all operating states over the entire intended lifetime.



The EASL team used simulation and analysis to demonstrate that the product would remain serviceable under all operating states over its entire intended design life. The team identified conservatisms in the analysis that could be exploited to improve design margins, demonstrate a longer life or provide a more economical design.

If you'd like to know more about this project or if you have a similar issue with your product or service, please contact us or take a look at the website.

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