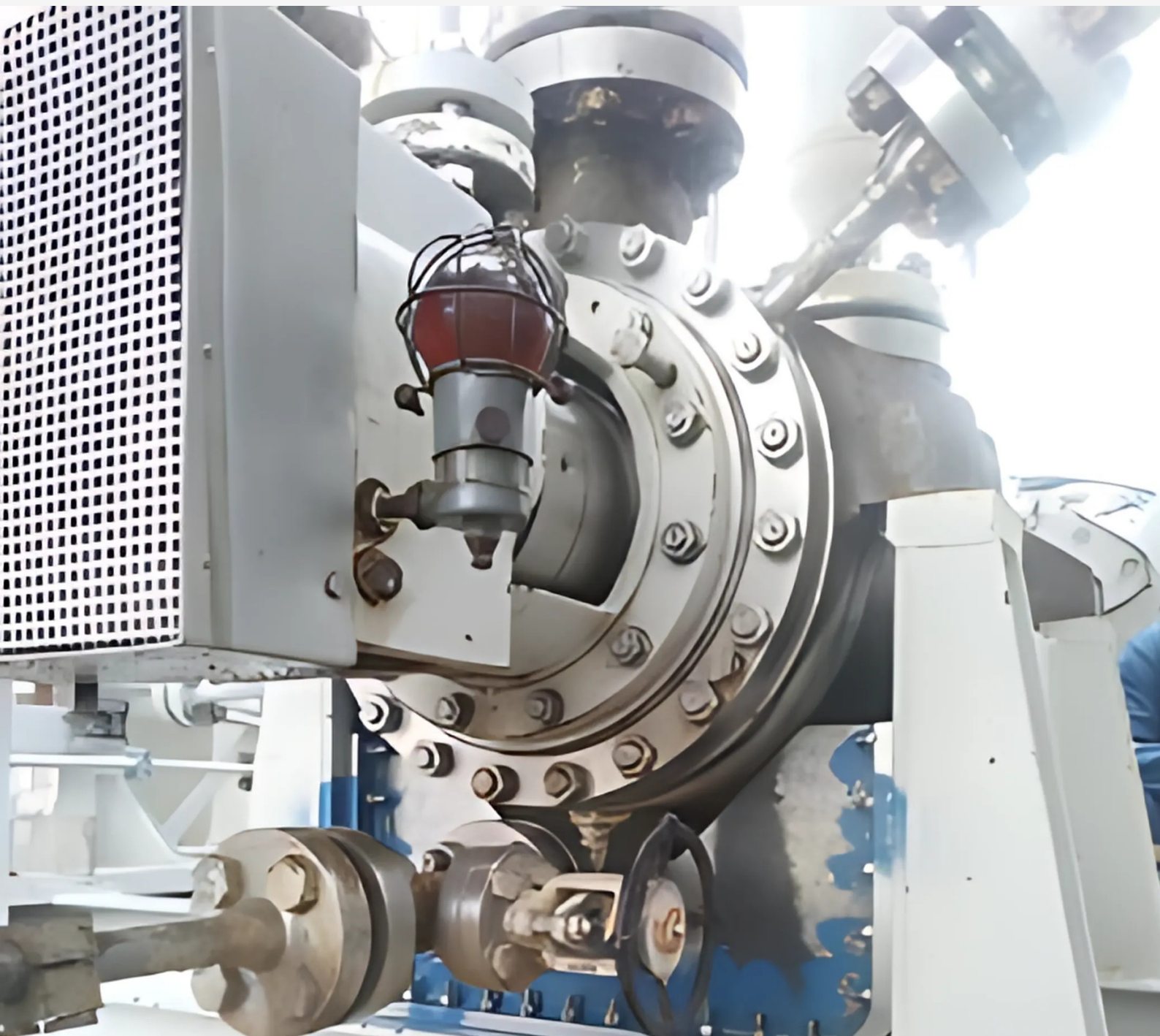


CASE STUDY

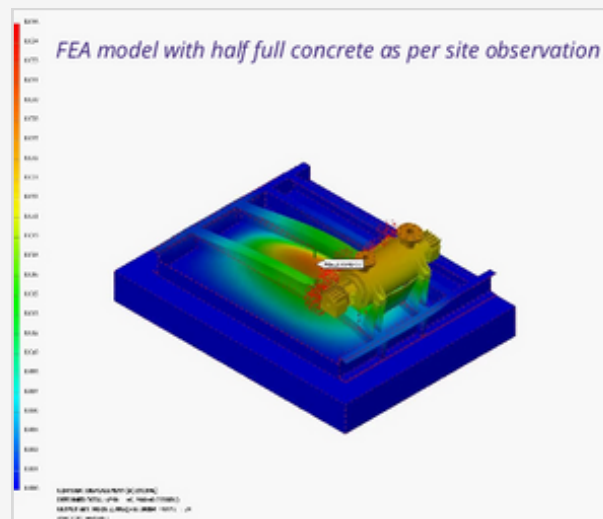


# ADNOC BAB Condensate Pump – Baseplate Modification



# The Challenge

ADNOC's BAB Condensate Pump units (Model 3XWB-10CL9, Tag Numbers 11-31-P-3701/3702) were experiencing chronic vibration issues, which led to repeated bearing failures. Preliminary analysis suggested that the problem stemmed from structural resonance at the pump's operating speed (2,980 rpm). Site observations revealed a grouting issue linked to the original baseplate design, compounding the vibration problem.

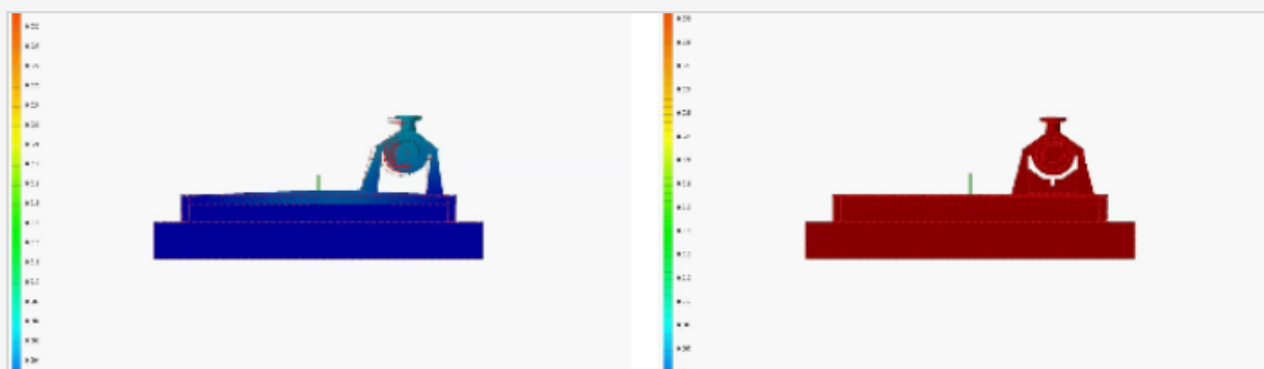


# The Solution

Torishima conducted a detailed multi-step analysis that included:

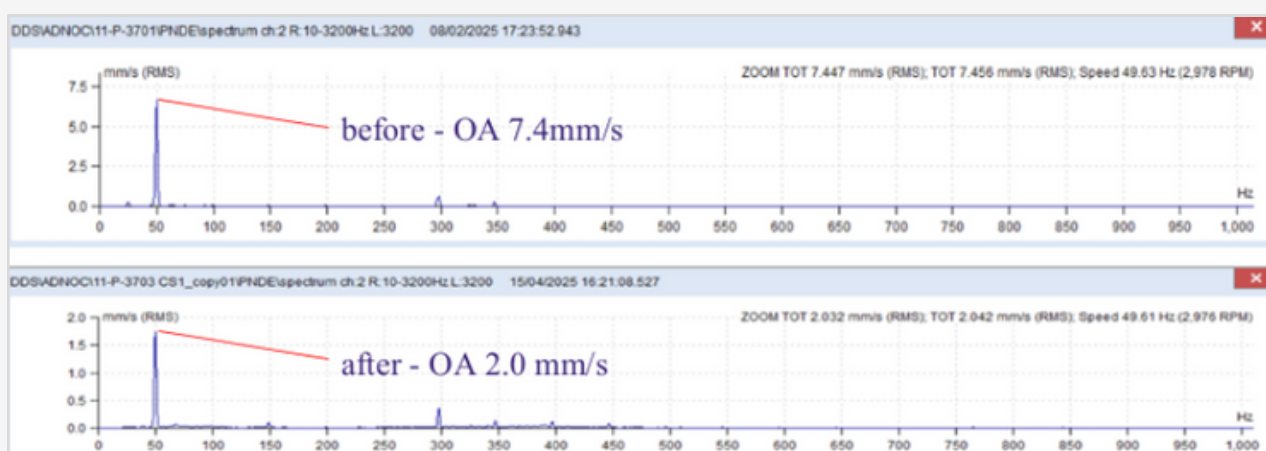
- Reviewing historical vibration data and site measurements
- Performing a Finite Element Analysis (FEA) to simulate mode shapes and identify resonance points
- Correlating FEA findings with physical site conditions, including grouting inconsistencies

A modified baseplate design was proposed and verified through FEA, aiming to shift the resonance frequency from 50Hz (matching the operating speed) to 59Hz - an 18% improvement. Though just short of the API standard of 20%, it was deemed a significant enhancement.



# Improvements

The solution was first implemented on unit 11-31-3703 without a pump overhaul. Vibration levels were reduced significantly from 16 mm/s to 4 mm/s. To further validate the solution, a recently overhauled pump from unit 3071 was installed on the modified baseplate (3703), and vibration levels dropped from 7.4 mm/s to 2.0 mm/s. Vibration spectrum analysis showed clear reductions at the resonance frequency (50Hz).



# Commercial and Environmental benefits

In addition to resolving the immediate technical issue, the baseplate modification delivered lasting commercial and environmental gains. Reduced vibration improved reliability and efficiency, leading to lower maintenance costs, energy savings, and a measurable reduction in carbon emissions

| Increased Efficiency                                                                                                                                                                                                               | Monetary savings                                                                                                                                                                                                                                         | CO2 Emission Reduction                                                                                                                                                                                                                                                                                                |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>Reduction in vibration led to smoother, more reliable pump operation</li> <li>Decreased mechanical stress on components extended equipment life and reduced maintenance downtime</li> </ul> | <ul style="list-style-type: none"> <li>Avoided costs of repeated bearing replacements and unplanned shutdowns</li> <li>Reduced need for reactive maintenance interventions</li> <li>Extended asset life reduced long-term capital expenditure</li> </ul> | <ul style="list-style-type: none"> <li>Improved mechanical efficiency contributed to more energy-efficient operations</li> <li>Lower power losses from vibration and misalignment reduced overall electricity consumption</li> <li>Indirect CO<sub>2</sub> emissions decreased through lower energy demand</li> </ul> |

## Conclusion

Through a data-driven approach combining site observation, vibration analysis, and FEA modeling, Torishima successfully identified and resolved a chronic vibration issue at ADNOC's BAB condensate pump station. The baseplate modification has proven effective in reducing vibration, improving efficiency, and delivering both commercial and environmental benefits. The results demonstrate the value of combining engineering expertise with digital modeling tools for long-term reliability and performance improvements.



# Driving Industrial Evolution.