

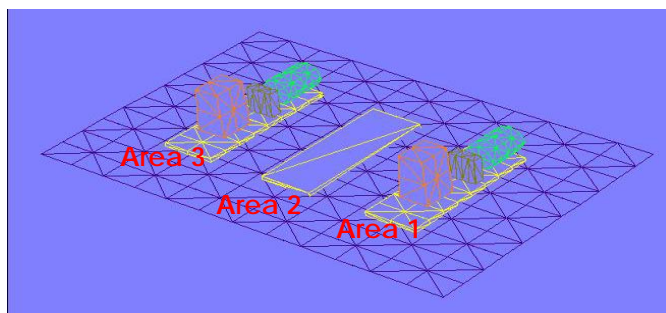
An Investigation of Structural Vibration on Condensate Transfer Pump at Resak Gas Production Platform, Off-shore Kerteh, Terengganu, 2003

Cracks on Condensate Transfer Pump (CTP) discharge pipe at Resak Platform, Offshore Kerteh, Terengganu were found at several different places. An immediate action was taken by investigating and identifying the source of vibration on the CTP structural and piping. Analysis techniques include Operating Deflection Shape (ODS) Analysis, Modal Analysis and Finite Element Analysis (FEA).

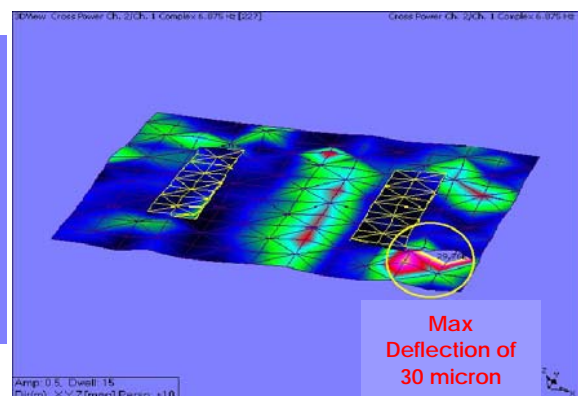
The investigation involved three CTP areas. ODS analysis has been performed for the entire three CTP floor beams area and their piping. Based on the ODS results, the source of vibration was coming from pump running speed frequency at 6.785Hz and its harmonics (up to 5x). It was observed that area 1 registered high vibration compared to area 2 and area 3. For the beam structure, maximum deflection occurred at area 1 up to 30micron rms. Meanwhile, the vibration level for the piping is also high at area 1 compared to the others. Therefore, area 1 is considered as the most critical area to be focused in this study. Beside that, ODS results also showed that the secondary beams was vibrating more than the skid and pump assembly. The movement of the beams was mainly in lateral (Y) direction and vertical (Z) direction.

In conjunction with the ODS, Modal Analysis has been carried out at area 1 in order to determine the natural frequencies of the beam structure. The beam structure has its lowest natural frequency at 17Hz which is its vertical bending mode followed by a few localized lateral bending modes at 24Hz region. In addition, all the obtained natural frequencies are confirmed with FEA which is modeled as per built plant drawing. Although it does not show a completely resonance problem, the combine effect of vertical and lateral bending has resulted in the discharge pipe deflection that eventually leading to cracks.

Modification using Finite Element analysis is aimed to stiffen the beam structure vertically and horizontally so as to push the modes to higher frequency. Modification with two beams added to the floor structure for each area has pushed the vertical bending mode to 33.5Hz and eliminated the localized lateral bending modes.



Wire-mesh model of the whole CTP floor area



Colour contour of ODS analysis on the floor beams and skids