



AS-BUILT DEETHANIZER COLUMN

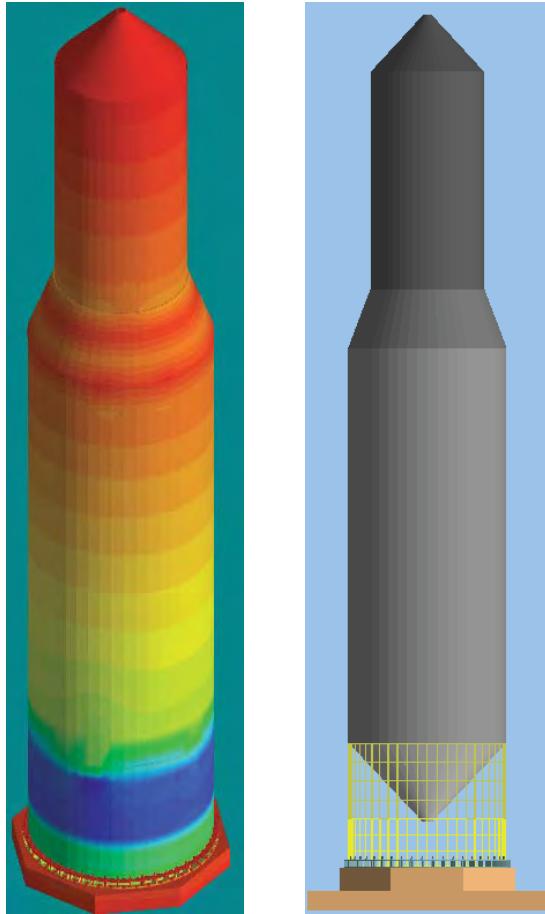
Yanbu, KSA, February 2009

Vulnerability Assessment - Installation Error

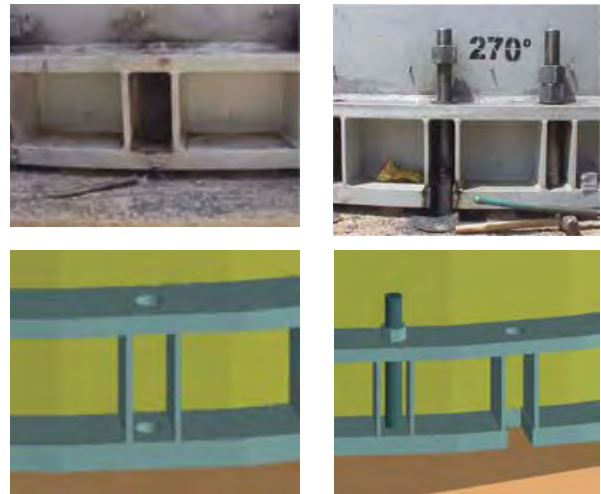
During the erection of a deethanizer column at Yanbu Gas Plant Expansion Project, a mismatch between the anchor bolts and the skirt upper base plate holes was observed. In order to complete the erection process, the column vendor widened and slotted nine holes in the skirt base plate and totally removed three anchor bolts. Additionally, several anchor bolts were damaged and several others were subjected to excessive heat during flame cutting. This raised concern about the safety of the newly developed structure.

ASI was able to :

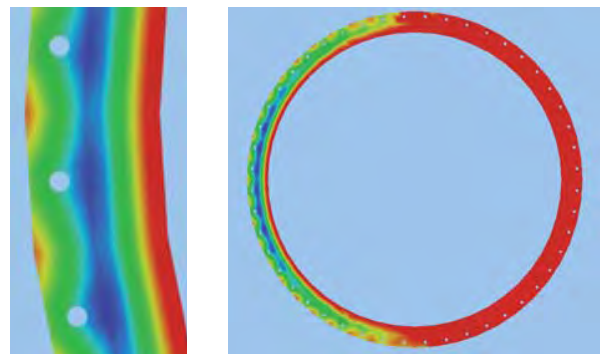
- Create a 3-D model for the as designed structure based on the available design drawings.
- Explicitly model all damaged bolts and all cuts done to the supporting plates.
- Perform nonlinear static and dynamic analyses of the structure under the effect of the required cases of loading including seismic and wind loading.
- Compare the behavior of the as designed structure with the actually built structure.
- Check stresses in all structural components.



Seismic Analysis Performed on the Weakened Structure



ASI's Model Versus the As-Built Structure



Stress Contours

Saudi ARAMCO tasked Applied Science International (ASI) to use its in-house structural analysis software Extreme Loading® for Structures (ELS) to provide comparative structural modeling and analysis of the deethanizer column skirt. The objective is to compare the "as-designed" case with the actual as-built/as-damaged cases under the effects of high wind and seismic loading conditions.

Based on the nonlinear analysis, ASI was able to assure ARAMCO that the as-built structure is safe with their required limits.

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