Optimization of Performance of Existing Inline Static Mixer

C2D Solutions Pte Ltd

Concepts To Design Solutions

Overview of C2D

C2D Solutions Pte Ltd is a holistic knowledge-based engineering solutions provider with a wealth of experience. We are committed to deliver the most optimal solution based on sound engineering principles.

Problem Statement

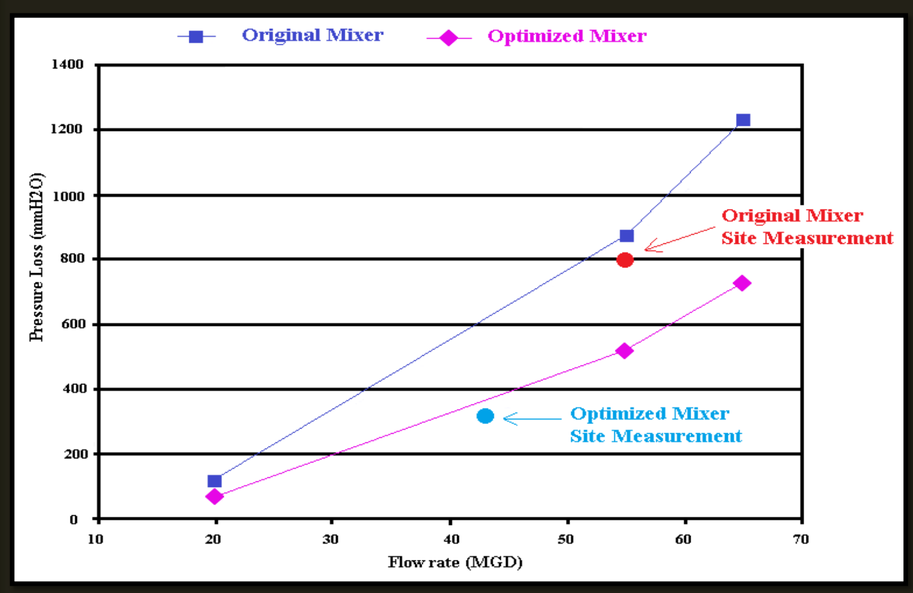
A gravity fed water treatment plant owned by an utilities provider was modified to include an Inline Static Mixer. However, the mixer was giving a much higher pressure loss than previously expected. The free board available downstream of the mixer is only 1000mmH_2O. At design flow (55MGD), the mixer is already giving a head loss of 800mmH_2O (site measurement).
Whenever the flow surges to about 60mmH_2O, the free board is overcome, resulting in back flow. The objective of this study is to propose alternative designs and predict the flow field and pressure drop across each mixer. The mixer is part of a gravity fed water treatment process. Alternative designs proposed must be easily modified from the existing mixer to safe cost. Alternative Designs must also ensure good mixing (low COV).

Challenge

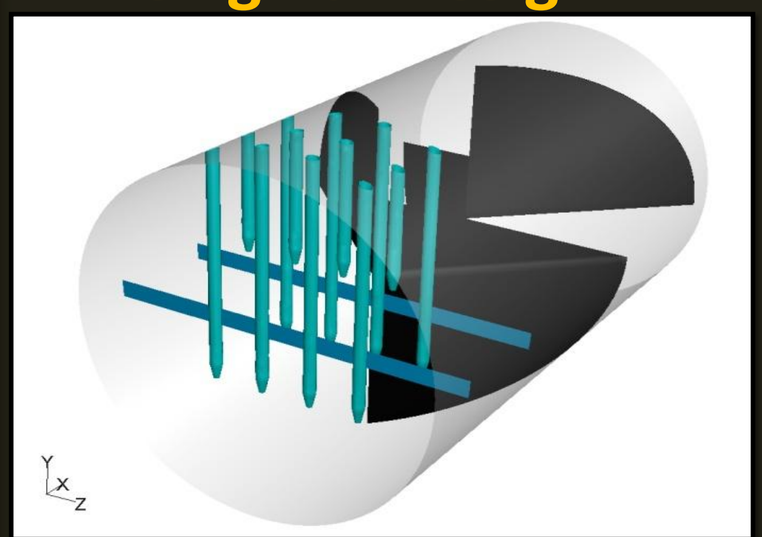
The free board available downstream of the mixer is only 1000mmH_2O. At design flow, the mixer is already giving a head loss of 800mmH_2O (site measurement). Whenever the flow surges to about 60mmH_2O, the free board is overcome, resulting in back flow. Alternative designs proposed must be easily modified from the existing mixer to safe cost. Alternative Designs must also ensure good mixing (low COV).

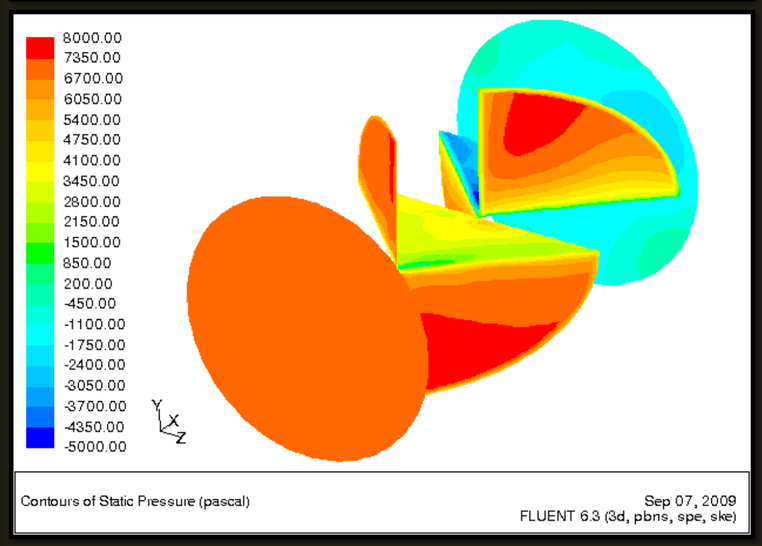
Solution

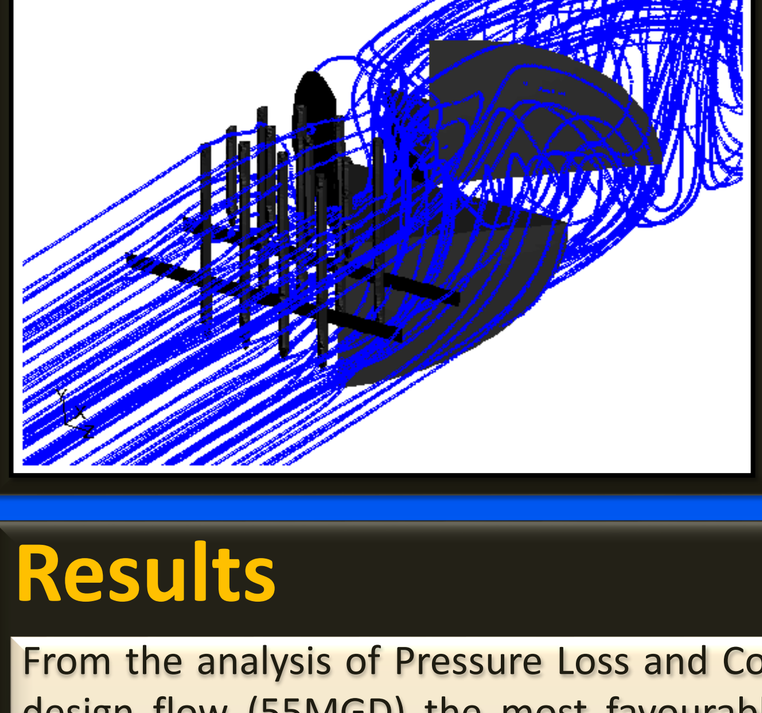
ANSYS FLUENT licensed CFD software was used to simulate the flow field and chemical dosing within the mixer. Validation studies were first carried to establish the appropriate mesh size and inlet turbulence levels. The validation was done on the original design model using pressure loss measurements at 55MGD. The measured pressure loss for the original design at 55MGD is 800mmH_2O and that of the CFD simulation is 870mmH_2O. The validated mesh size and turbulence parameters were then used to simulate all alternative designs.



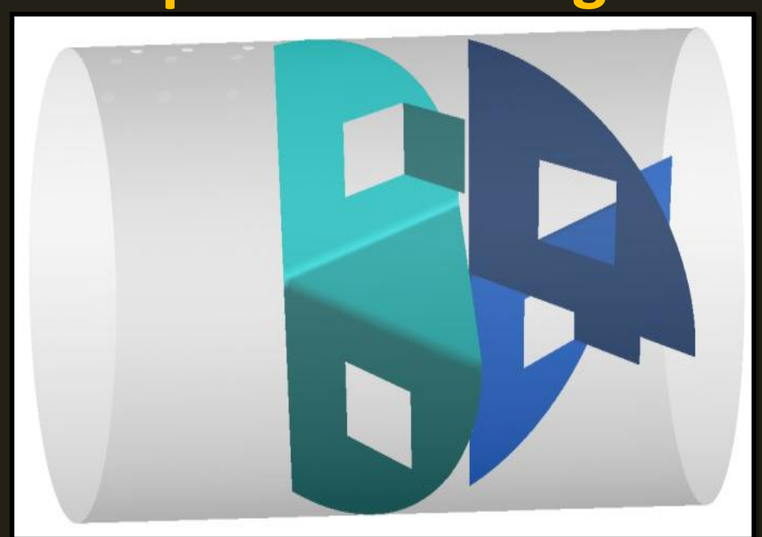
Original Design

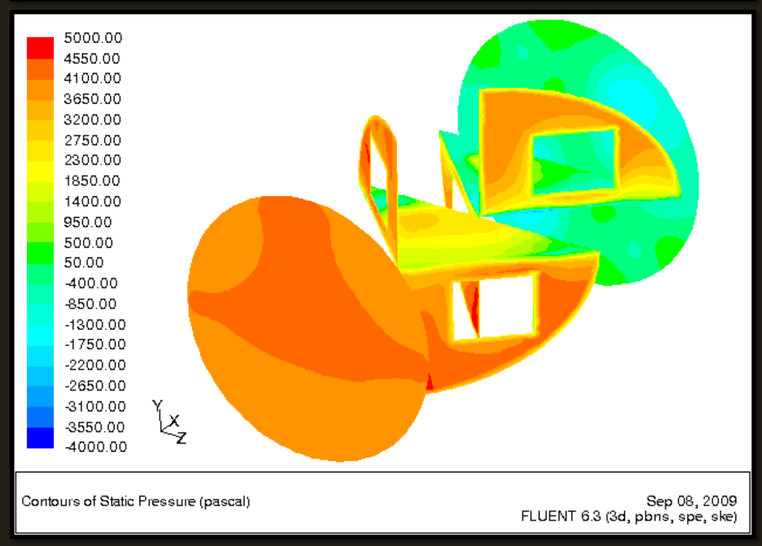


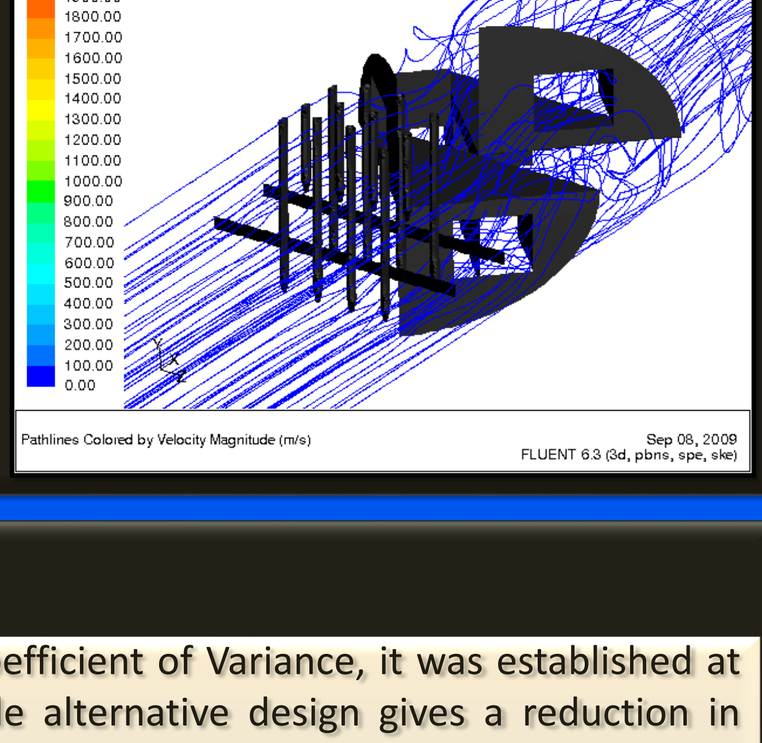




Optimized Design







Results

From the analysis of Pressure Loss and Coefficient of Variance, it was established at design flow (55MGD) the most favourable alternative design gives a reduction in pressure loss of 40% (521mmH_2O), while maintaining a low COV. A recent test done on the modified mixer shows the head loss at 43MGD is 320mmH_2O, while the CFD result at 43MGD is 365mmH_2O. This shows that the CFD results is similar to the tested data and only errs minimally on the conservative side.