Rapid Prototype for Static Mixers in Water Treatment

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

Static mixers are an integral part of all water treatment and process facilities. Static mixers, as the name suggests, have no dynamic components and thus requires little or no maintenance. Any application where dosed chemicals have to be mixed effectively with minimum mechanical interface requires the presence of a static mixer. Well designed static mixer should offer good mixing while introducing minimal pressure losses.

Challenge

The challenge of designing static mixers lies in the trade-off between effective mixing and head loss across the mixer. A very rudimentary mixer with sufficient baffles obstructing and diverting the flow will provide reasonable mixing, but the resulting head loss will be extremely high. The tasks of designing a mixer that delivers good mixing while maintaining a low pressure loss requires conceptualizing and testing various prototypes. This largely iterative process if done physically can be very impractical from a time and cost perspective.

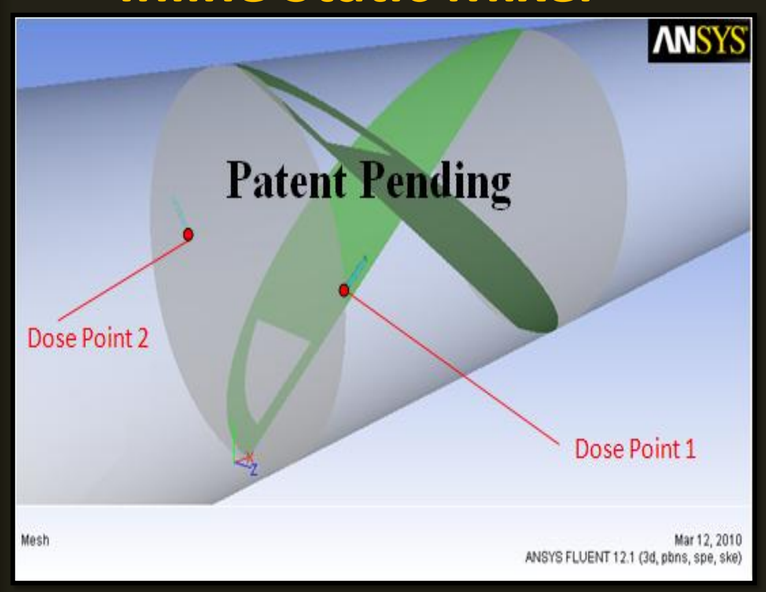
Solution

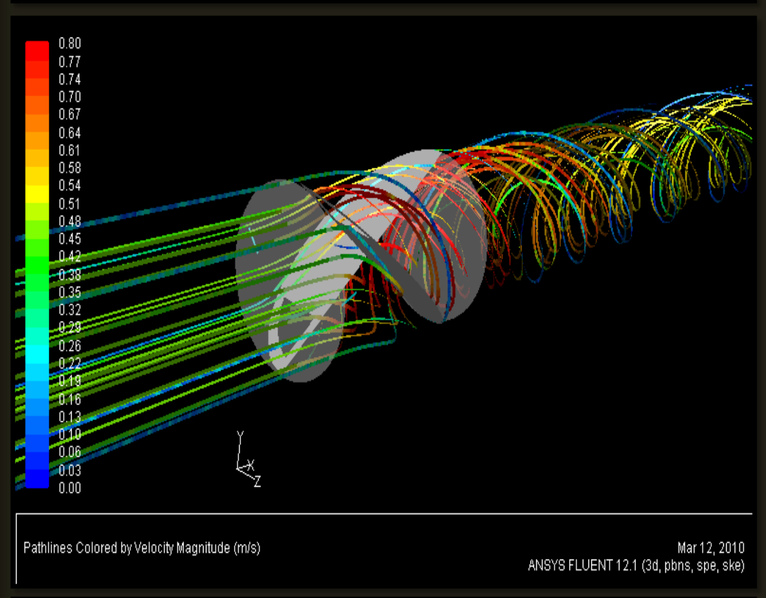
In order to enable rapid prototyping, various conceptualized designs were first modelled using Computational Fluid Dynamics (CFD). After iterative refinement using CFD, the most promising designs for the Inline and Open Channel Mixers were selected. The prototype models of the selected designs were then fabricated and validated experimentally.

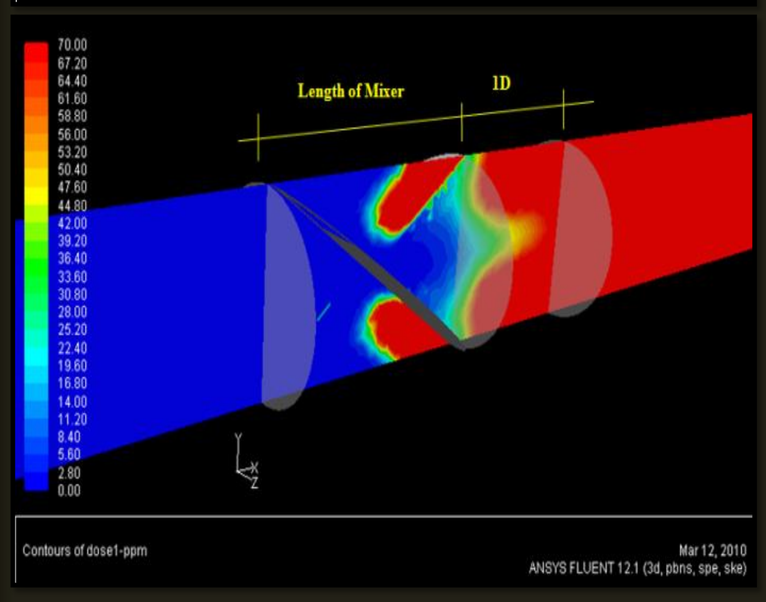
Results

The rapid prototyping using CFD proved highly time and cost effective. The computed pressure loss and mixing (represented by the downstream Coefficient of Variance, COV) results agreed very well with the experimental results of the prototypes. The validation of the CFD methodology also allows the development of an extended range of static mixers without the need for further experimental prototyping.

Inline Static Mixer



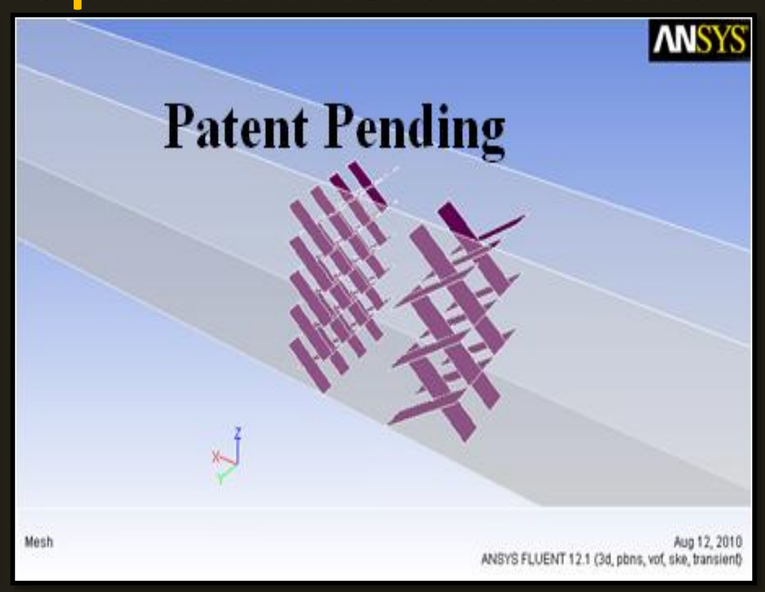


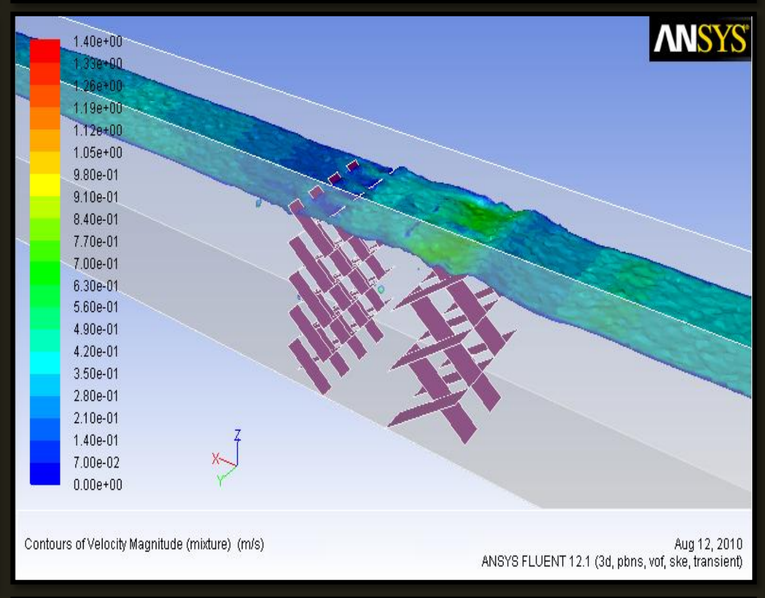


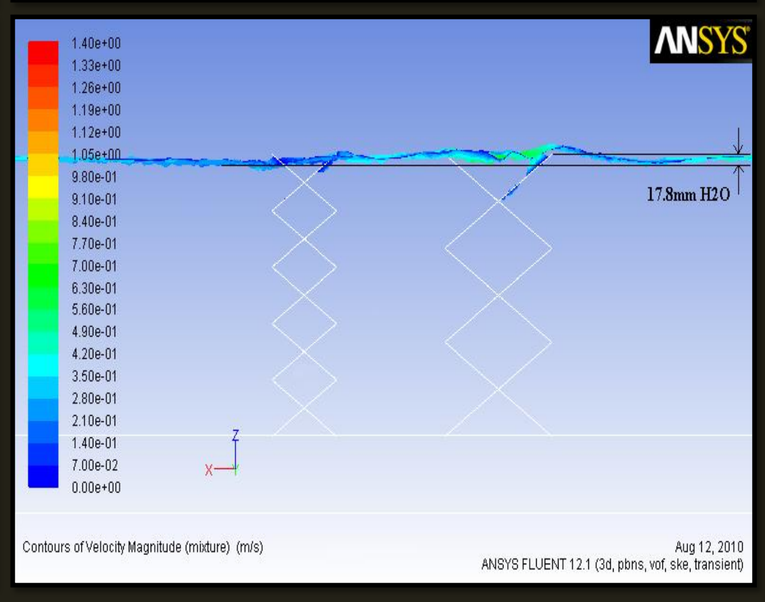
Pressure Loss (Pascal)			
Flow Velocity = 0.15m/s		Flow Velocity = 0.3m/s	
CFD	Expt.	CFD	Expt.
45	40	178	120

COV @ 1D Downstream			
Flow Velocity = 0.15m/s		Flow Velocity = 0.3m/s	
CFD	Expt.	CFD	Expt.
2.59%	Not Available	3.05%	1%

Open Channel Static Mixer







Pressure Loss (mmH2O)	
Flow Velocity = 0.2m/s	
CFD	Expt.
17.8	12.6

COV @ 1W Downstream	
Flow Velocity = 0.2m/s	
CFD	Expt.
1.72%	Not Available