# Impact of Geometric Design on Mixing Efficiency in Hydraulic Contact Tanks: Sharp Inlets and Baffle Opening Lengths

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**Abstract.** Flow through hydraulic contact tanks tends to be highly sensitive to geometry. With this in mind geometric aspects should be carefully considered during the design of a contact tank in order to optimize performance. Two aspects in particular are known to have strong effects on overall system performance, namely, baffle and inlet configurations.

In the case of baffles we find it desirable to answer a key question: for a given footprint of a rectangular tank with a specified inlet width $W_{inlet}$, how does the hydraulic efficiency of a baffled tank depend on baffle configuration? After model validation using physical data from previous research efforts, thirty high-resolution two-dimensional CFD simulations were performed to quantify hydraulic efficiency of a laboratory-scale tank. The results indicate that the hydraulic efficiency of an arbitrary baffled system can be optimized by ensuring that the baffle opening lengths should be roughly equal to the width of the channels in the tank, which holds true independent of other geometric parameters.

When an ideal inlet is not possible, "sharp" inlets are used to introduce flow to the tank by a high-speed turbulent jet. This gives way to second-rate flow dynamics that negatively affect performance throughout the entire tank. We therefore wish to ask: what inlet modifications, if any, can be easily and economically implemented to increase hydraulic mixing efficiency? To answer this physical tracer studies were performed on a full-scale baffled prototype with seven simple inlet modifications. Six of these were found to increase contact times substantially. The T-shaped inlet was the most successful, outperforming the unmodified inlet by up to 70% as assessed by the baffling factor parameter. These results are explained by means of a hydrodynamic analysis from validated CFD simulations.