REAERATION TEST AT WEIRS USING OXYGEN-ENHANCED ENVIRONMENT

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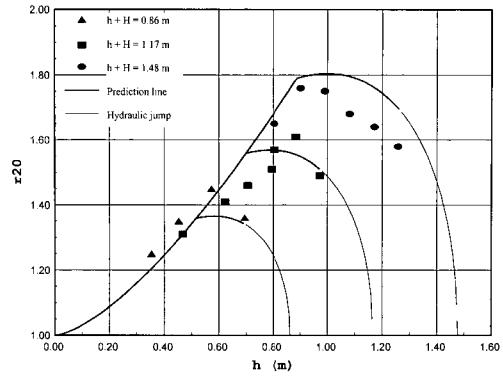
Weirs have been used to increase dissolved oxygen (DO) concentrations in rivers by facilitating oxygen transfer from air into water. As the water passes through a weir and plunges into a downstream pool, air bubbles are entrained into the water. The primary reasons for the enhanced oxygen transfer are increased air-water surface area due to the entrained air bubbles and high mixing intensity caused by the plunging nappe. The objective of this study is to investigate the role of tailwater depths in predicting and maximizing oxygen transfer at low drop weirs with relatively high flowrates.

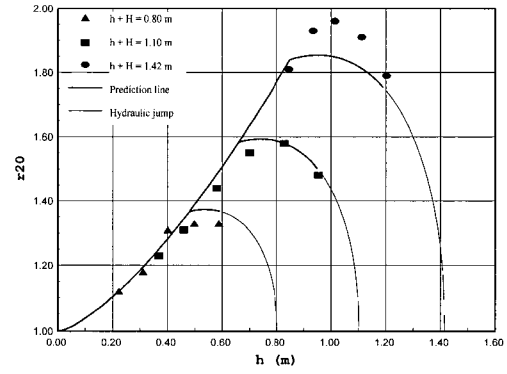
The experimental apparatus included a flume, weir, fan, adjustable sluice gate, and DO meters, as shown in Fig. 1. The entire flume was covered with plastic sheeting, and 95% pure oxygen was injected into the flume atmosphere to provide the Oxygen Enhanced Environment, which, in deed, resulted in increased saturation DO concentrations. The variation in the deficit ratio as a function of tailwater depth was evaluated using unit discharges of 167, 334, and 502 $m^3/h{\cdot}m$ and weir heights of 0.54, 1.04, and 1.36 m.

The oxygen-enhanced environment provided sufficient DO deficits between saturation and upstream concentrations. An average saturation concentration of 14 mg/L was maintained during the testing to provide an average DO deficit of 6 mg/L. This value is more than two times larger than 2.5 mg/L of the minimum DO deficit suggested by Gulliver and Rindels (1993) for a reasonable accuracy in the oxygen transfer measurement.

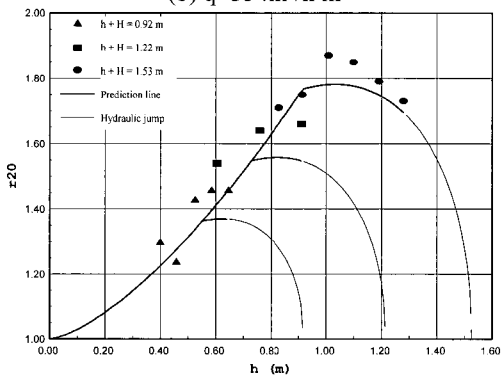
An equation for predicting the oxygen transfer at weirs is developed as a function of jet Froude number, drop height, and tailwater depth. Fig. 1 shows the deficit ratio as a function of drop height. It was found that the tailwater depth should be included in oxygen transfer models at weirs, but designing for optimum tailwater depth to maximize oxygen transfer is not as important as previously thought. Flexible tailwater depth adjustment is recommended to take into account various design conditions.



(a) q=167m^3/h·m



(b) q=334m^3/h·m



(c) q=502m^3/h·m

Fig. 1. Deficit ratio as a function of drop height.