Redesign of VFC Hydro-Brake

4th year group project with Hydro International

Figure 1: Left, CAD drawing of surge chamber and hydro-brake. Right; installation of surge chamber in real life.

The project group consisted of eight 4th year engineering students from the Mechanical and Civil engineering programmes. Work tasks included experimental work (building an operating an experimental rig in the Fluid Dynamics laboratory here in Exeter, and using the company's facilities in Clevedon), theoretical and computational (Computational Fluid Dynamics, or CFD, modelling of the water flowing through the device under various flow regimes). The primary objective was to discover the effect of different outlet shapes on the behaviour, or characteristic curve, of the device.

The Hydro-Brake Flow control is a self-activating Vortex flow control device used to control the flow in urban drainage applications. It has no moving parts and zero energy requirements. For low flow rates it acts as a simple weir allowing free flow of water through the system. At higher flow rates (e.g. after a storm) it uses the upstream hydraulic head to generate an air-filled vortex at the centre of the device, which throttles the water flow through the system allowing it to be diverted to secondary storage. Regulating the flow in this way prevents storm surges from sweeping through the drainage network, causing flooding lower down in the system. Instead the diverted storm water can be stored until pressure on the system has eased. This sort of flow control is an important part of modern, environmentally sustainable design of Urban Drainage systems.

Hydro International is a medium-sized UK company based in Clevedon (close to Bristol). They develop and market a number of devices for Urban Drainage applications, with a particular emphasis on sustainable Urban Drainage. The Vortex Flow Control (VFC) Hydro-Brake is one of their flagship products in this area,

Above: Figure 2. Student project group with supervisor Dr Tabor
Below: Figure 3. 3d CFD simulation of flow through VFC.
Bottom: Figure 4. Hydro International's experimental facility at Clevedon