

The Optimisation of Slurry Separation within Pipe Jacking

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Abstract

Pipe jacking is an environmentally friendly technique for the installation of services and utilities which leads to minimum disturbance during installation. It is an important construction method for urban environments where disruption to transport is expensive. The need to tunnel through varying geologies requiring support during tunnelling has led to the increased use of slurry tunnel boring machines. The slurry is used to stabilise the tunnel face and transport the excavated spoil to the surface.

The slurry, which includes the excavated material, has to be separated into liquid and solids so that they can be transported off site and disposed of. Current legislation does not allow for liquid waste to be disposed of straight to landfill and transportation and offsite treatment of liquids is extremely costly. Therefore improving the separation process on site helps reduce the cost of disposal.

This thesis looks at issues seen on current pipe jacking sites and investigates the optimisation of the decanting centrifuge commonly used by contractors to separate the sub 63 μm particles. The testing carried out using a decanting centrifuge showed that the separation plant operator (mud man) requires an in-depth knowledge of how to control the plant to gain maximum separation capabilities. The slurry feed rate to the centrifuge was found to affect the centrifuge outputs significantly. At high flow rates the water content of the cake was seen to decrease. However the clarity of the liquid discharge (centrate) deteriorates. This allows the mud man and site management to make decisions on centrifuge control depending on excavation rates, geology, site/disposal constraints and ability to control slurry density.

Other key findings related to the dosing of flocculants when using a centrifuge. Flocculants were clearly seen to increase the water content of the cake and the liquid limit of the cake, showing that although the use of flocculants is essential, careful dosing is required to control the quality of the centrate and reduce trapped water being taken off site in the solids.