# An investigation of flow characteristics in slope siphon drains

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## Main goal of this paper

The flow characteristics of siphon drainage are significantly influenced by the hose diameter. In slope engineering, a 3.6 mm polyurethane (PU) hose is recommended for siphon drainage to maintain its long-term effectiveness.

## Main observation in model test

Water flows in the form of a wall pressing flow in a large diameter siphon hose (e.g., larger than 5.0 mm) under low flow velocity, which leads to discontinuous siphon drainage. However, water flows in the form of an integral slug flow in a small diameter siphon hose (e.g., smaller than 4.0 mm) under low flow velocity, which leads to continuous siphon drainage.

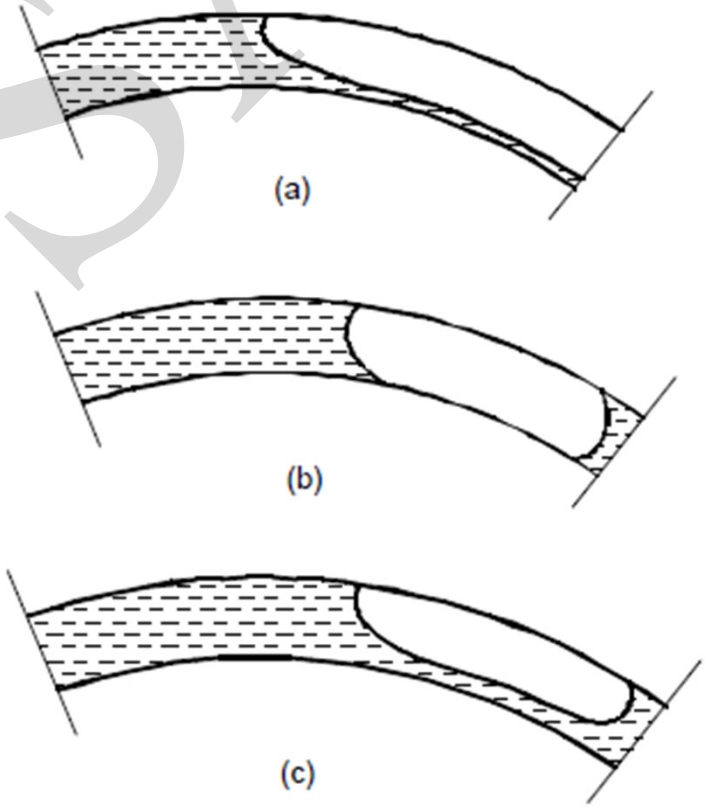


**Fig. 4 Three types of flow at the vertex of hoses**
(a) Wall pressing flow; (b) Slug flow; (c) Incomplete slug flow

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## Computational model and results

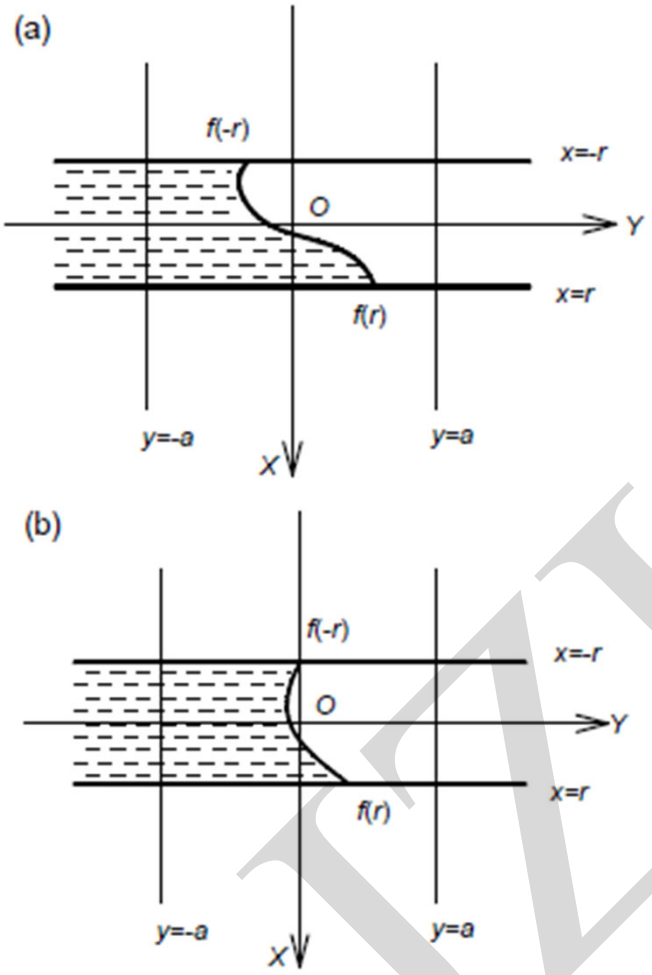


**Fig. 6 Surface shapes for hoses with different diameters**
(a) $r>r_c$; (b) $r\leq r_c$

The threshold of hose diameter can be theoretically obtained. Wall pressing flow is more likely to be generated in the lower hose when $r>r_c$, while complete slug flow can be generated when $r<r_c$.

$$r_c = \sqrt{\sigma_{lg}\cos\theta / \rho g}$$

PU hoses with a diameter of 3.6 mm are recommended, to guarantee the long-term operation of siphon drainage.

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